The Electrical Industry's Weekly Magazine

October 28, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

'58 Pitch Aims at Boosting New Home Load ...Page 47

Iowa Power Plan Saves $140 Million...p 44

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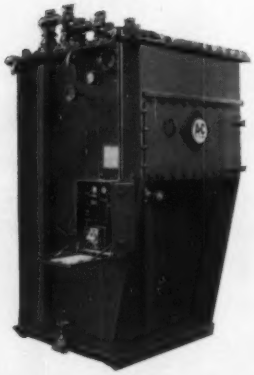
reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

Longest contact life

Heavy components and rigid design maintain highest contact pressures available in industry and assure long service life because . . .

- High contact pressure minimizes contact blowback caused by severe short circuits.
- Contact bounce and consequent pitting and burning are reduced.
- Large contacts increase thermal capacity.
- Quick-break mechanism snaps contacts fast for reduced arcing time.
- Contacts made of sintered RS-1045 greatly resist pitting and burning.

These are just a few of the many reasons for the outstanding service record of Allis-Chalmers 3-phase regulators. For complete details, contact your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



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ALLIS-CHALMERS

Electrical World

Vol. 148, No. 18 October 28, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Integrated expansion plan would save about $140 million in the 1960-1975 period....p 44

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Soggy land and heavy reels of Okonite Cable presented a rugged installation problem. But by digging a 4-foot trench, and by "putting the Cat before the truck before the float," Guarantee Electrical Co. laid down two cables simultaneously at three miles per hour. Cables were a 15kv, 3-conductor Okolite-Okoprene submarine power cable and a 24-conductor Okolite-Okoprene submarine control cable designed to assure the continuous water supply essential to plant operation.

"We specified Okonite because...

This tough installation called for top-quality cables to assure continuous plant operation"

"Demanding assignments are 'our meat'," says Arthur Kaspar, Chief Electrical Engineer of Guarantee Electrical Company of St. Louis. "A good example is our recent cable installation for a large plant here in Missouri.

"Our client specified a never-failing, 24-hour-a-day, controlled source of plant water. The best pumping station site was miles from the plant, in low-water marsh land subject to periodic flooding from the Mississippi River—up to 25 feet above river level. One thing was certain . . . this called for really dependable cables for power and for control of the complex pumping station that would supply the water to the plant.

"Another thing was certain, too . . . this was a job for Okonite. Our experience has taught us that Okonite gives maximum insurance and value where dependability in vital circuits is concerned."

Conferences between Mr. Kaspar and Okonite developed the proper cables: unaffected by water, highly resistant to soil conditions and other factors that attack *any* buried or submerged cable, and backed up by Okonite's 78 years of making highest-quality cable.

* * *

For your vital circuits, take a tip from Mr. Kaspar and other leading electrical engineers and specify Okonite. Whatever the installation, when you talk to Okonite you'll get an unprejudiced recommendation for your cable needs because Okonite, *and only Okonite,* makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.

5248

***where there's electrical power... there's* OKONITE CABLE**

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. . . from the publisher

There's a knack to reading Electrical World. Here's the fourth in our current series to help you get more reading mileage for your time.

Tip No. 4—Save Tear Sheets

"What are we going to do about the voltage drop out on the Route 4 line?" asks the district superintendent. An engineer pulls open a bottom desk drawer, takes out a loose-leaf binder marked "Capacitor Installations" and begins leafing through pages torn from past issues of Electrical World. After a few minutes of study and talk the two men come up with a solution.

Such is the way a field engineer at Kentucky Utilities uses his EW subscription.

Every week you'll find a story or two you will want to have handy for use later on. Tear it out. Many readers keep separate files classified by subject matter. Then when a particular problem comes up, they have a ready source of ideas and background material. Comes in handy for reports and speechmaking, too.

Next year, EW plans to perforate some of its key pages—an added service to help you build up your reservoir of job data.

Fischer Black

ELECTRICAL WORLD

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NOW! low-cost load switching for your entire distribution system... just hook Loadbuster® across this new S&C Tool Operated Disconnect

That's right! Now you can make load switching universal. At the same time you get the rugged reliability you'd expect from a station-type disconnect, while paying no more than you would for distribution-type disconnects.

This new S&C Tool Operated Disconnect switches loads dependably with Loadbuster, S&C's portable loadbreak tool, and it is the only distribution disconnect with published short-time ratings and published insulation values.

Why is this published data important? Just take a look at what has been happening on distribution lines in the past few years—

Today's Disconnect Problem

Performance requirements for disconnects have risen rapidly as a result of higher voltages, 400-ampere loads, and alarming increases in available short-circuit currents. This type of duty might suggest the use of 600-ampere, station-type equipment, but distribution system budgets can't stand the cost.

Yet the job is too heavy for the ordinary distribution disconnect which has inadequate short-time capability, substandard insulation characteristics, insubstantial construction, no load switching potentiality, and extremely limited repetitive capability.

Up until now there has been no device to fill the void—no disconnect suited to a modern, high-reliability, distribution system, yet matching distribution economics. To meet this need, S&C is introducing this Tool Operated Disconnect. It meets the rigorous requirements conventionally filled by group-operated disconnects, hook-operated, station-type disconnects, and conventional load interrupters.

. . . and Load Switching Needs

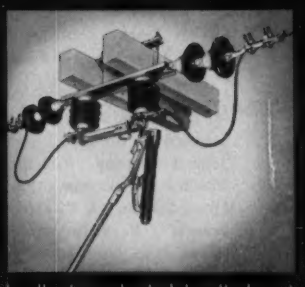
Load switching is a serious problem today. Primary distribution voltages of 12-14 kv, currents of 100 to 400 amperes, and the associated charging and magnetizing currents cannot be switched without establishing persistent, spreading arcs.

Until recently, the only dependable solution to load switching needs has been the load interrupter, whose cost can only be justified at substations, subtransmission sectionalizing points, and at key sectionalizing points. Now with this new disconnect you can have universal load switching—economically—using Loadbuster.

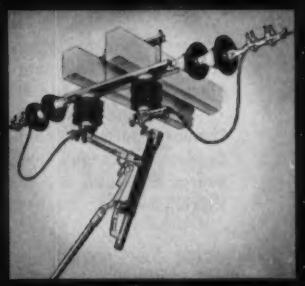
Portability the Key

The key to the Loadbuster system of load switching lies in portability —bringing the interrupting device to a matched disconnect or cutout only when load switching is desired. The cost of Loadbusters is spread over all the disconnects and cutouts in a distribution system.

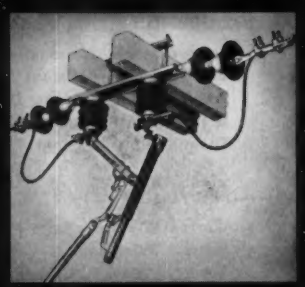
Today you can solve the disconnect problem for your system with S&C's Tool Operated Disconnect . . . a distribution device that doubles for station-type equipment. And since this Tool Operated Disconnect is matched to Loadbuster, load switching comes free! Write for full information.



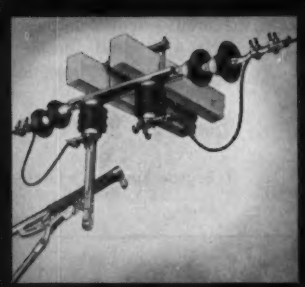
Loadbuster is hooked to attachment hook of disconnect



Loadbuster is pulled downward, opening disconnect blade



Loadbuster interrupts circuit and latches open



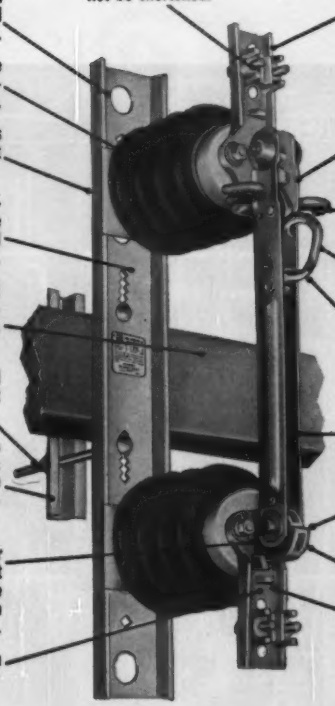
Loadbuster freed from attachment hook; to be twisted from pull ring

How Loadbuster Works

Attached to a universal pole, Loadbuster is simply hung on the attachment hook of the Tool Operated Disconnect, and the pull ring hook inserted in the pull ring. As the pole is pulled downward, the disconnect is opened, but a current path is retained through Loadbuster. As the movement continues downward, Loadbuster trips, breaking the circuit positively. It's that easy! There's no arc, no contact burning, and no danger to the lineman operator.

Designed to withstand usage over a long time without maintenance, Loadbuster is operable at any distribution system voltage through 14,400 volts, and can break all load currents through 400 amperes, as well as associated magnetizing and line charging currents; it can also switch all pole top capacitor banks.

the new S&C Tool Operated Disconnect



Connector Bolts can be inserted in one direction only so electrical clearance cannot be shortened.

Dead-Ending Provision base has holes in each end for dead-ending conductors.

Post Insulators provide large leakage distance between live parts and base.

Husky Channel Base gives flat bearing surface against crossarm.

Versatile Mounting Provisions for single and double crossarm, also structure; all needed hardware included.

10½" Metal-to-Metal Open Gap Distance is unusually long for distribution disconnects.

Mounting Bolts extend away from blade, protect clearances to live parts.

Rigid Back-Up Members permit secure draw-up. Bolts insertable only in one direction as shown to maintain electrical clearance.

Double-Stud Insulator Mount insures against shifting or turning of live parts, particularly when closing blade from the side.

Current Path virtually a straight line.

Dual-Purpose Connectors tinned to take aluminum or copper. Large area, reversible clamp accommodates wide range of conductors—up to 450 Mcm copper and 336 Mcm ACSR.

Silver-to-Silver Contacts backed up by stainless steel contact pressure springs.

Attachment Hook for Use with Loadbuster also serves as blade guide.

Positive Latch and Pry-out operates freely from all angles of approach.

Pull Ring Position gives compact construction—with minimum clearance requirements for open blade.

Heavy, Embossed Blades insure positive alignment when closing in.

Machined Contact Surfaces for best possible contact.

Positive 90° Blade Stop

Cable Stop prevents cable end from interfering with disconnect blade action.

Only Distribution Disconnect with Published Performance Data

The performance built into this disconnect (see below) is unmatched in the field of distribution disconnects . . . and the S&C Tool Operated Disconnect costs no more. Plus cost-free load switching! Designed for use with Loadbuster®, this disconnect is, when required, a load interrupter for currents up to 400 amperes.

That this disconnect will give years of maintenance-free, urban or rural service is clear from the construction details shown at the left.

The new disconnect comes complete with all necessary hardware for both single or double crossarm mounting (vertical or inverted), for use with both aluminum and copper conductors. There is nothing extra to buy or to specify.

15 kv—400 amp

	Ratings						Interrupting Capacities			
	Kv			Amperes			Inches		Withstand Test Voltages kv (RMS), 60-cycle	
	Nominal	Max. Design	Impulse Withstand (Crest)	Continuous	Short Time (Momentary)		Leakage	Dry Arcing	Wet	Dry
Branch Feeder	15	15	95	400	20000	12500	13-3/4	6	50	42
Main Feeder	15	15.5	110	400	20000	12500	17	7-1/4	50	45
Station Pin Insulator	15	15.5	110	400	20000	12500	12	7-1/4	50	45
Station Post Insulator	15	15.5	110	400	20000	12500	15-1/2	7-1/4	50	45

Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

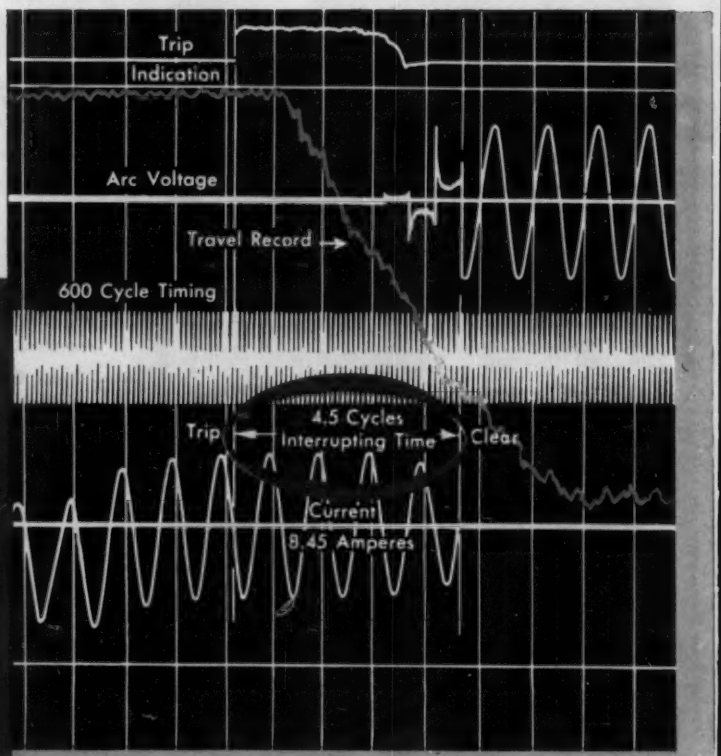
4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

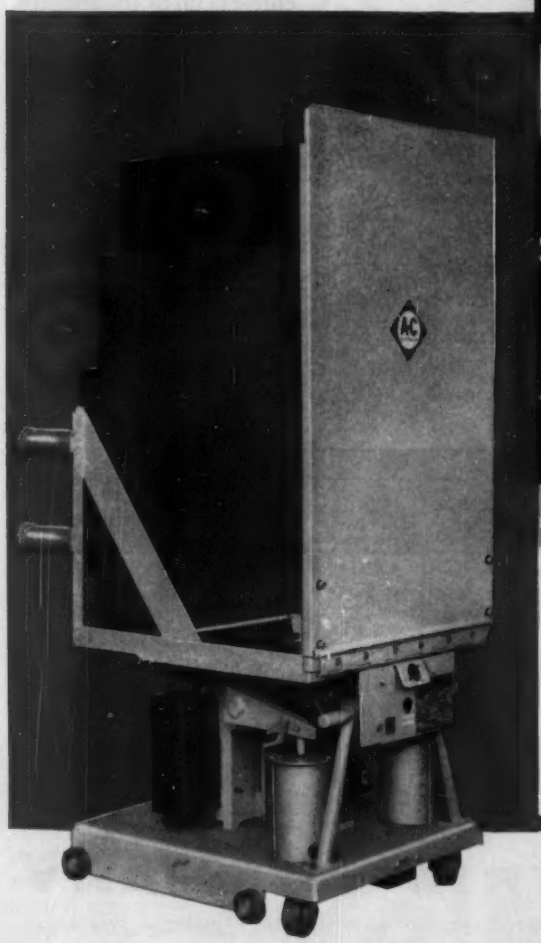
Get 5-cycle interruption with

Reduce conductor sag—

For greatest benefit, fast interruption of all currents is essential. These oscillograms, typical of Allis-Chalmers air magnetic breakers, show fast clearing time on low, medium, and high currents.



FAST ON LOW CURRENTS



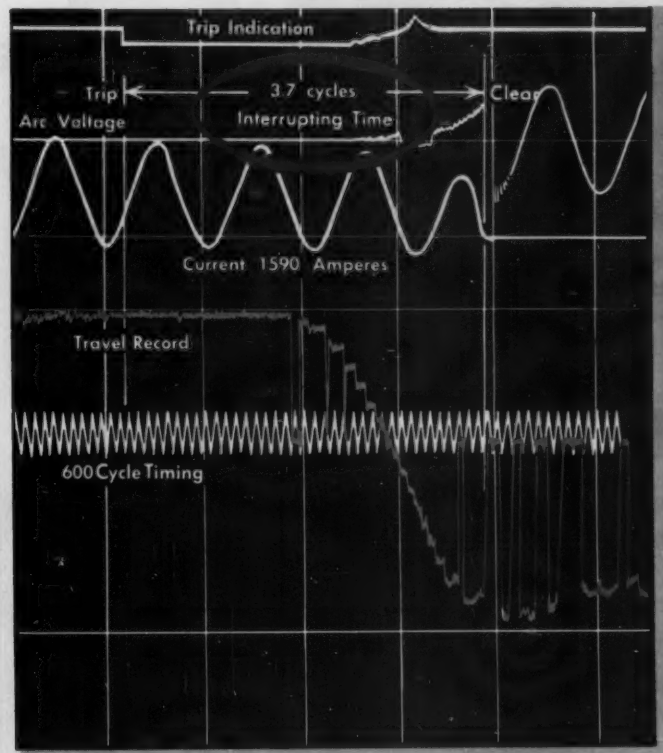
Fast clearing time reduces the damage of a fault to the system. Problems of sagging wires, annealing, and burndown are reduced. Outages are often eliminated.

All Allis-Chalmers air magnetic switchgear

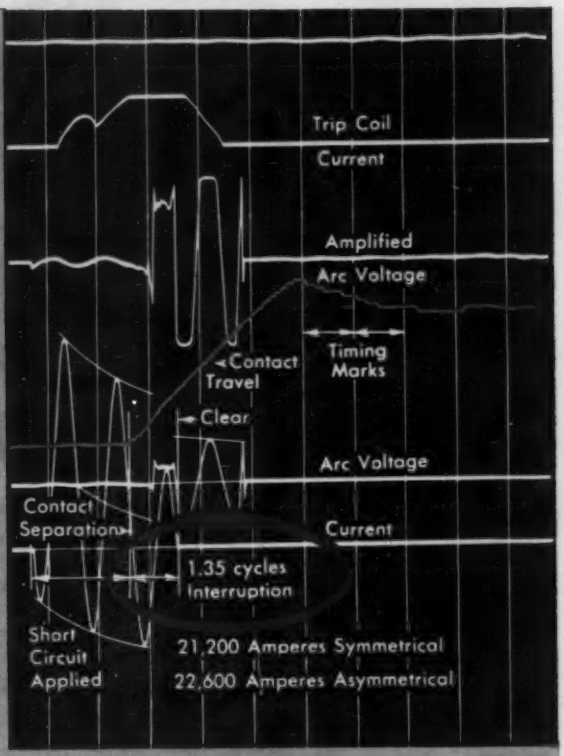
ALLIS-

all Allis-Chalmers air magnetic breakers

annealing—burndown



FASTER ON MIDRANGE CURRENTS



FASTEST ON HIGH CURRENTS

assemblies and primary unit substations are equipped with 5-cycle *Ruptair* breakers.

For additional information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Ruptair is an Allis-Chalmers trademark.

For Progress in Switchgear

CHALMERS

A-C ALLIS-CHALMERS

A-5470

ISOLATED PHASE BUS

Typical assembly with sliding section open. Two-way sliding section provides easy access to connectors—simplifies inspection and maintenance—effects savings in installation and operation.

SO MUCH MORE FOR THE SAME MONEY

All isolated phase bus meets industry standards; performs satisfactorily at rated current, voltage and temperature rise, with standard impulse levels; sells at competitive prices. But when selecting isolated phase bus for generator or any other applications, it is necessary to consider cost, *plus* installation and operating advantages. Here are some of the superior inherent advantages of I-T-E Isolated Phase Bus design that are not covered by industry specifications, yet effect substantial savings in installation and operation:

Most Simple and Efficient Design thermally, electrically and mechanically.

Fewest and Most Durable Gaskets, meaning direct savings in installation time and maintenance.

Greatest Installation Flexibility.

Tightest Bus ever designed. Dust and water leakage are eliminated.

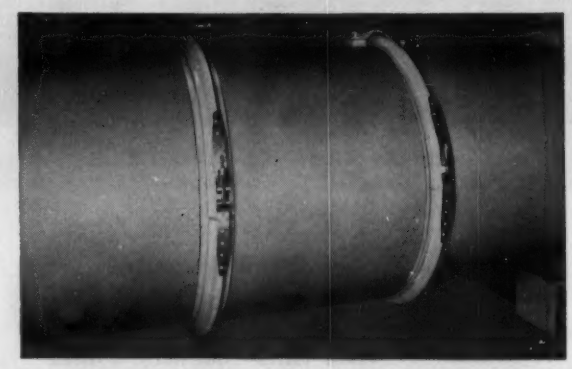
Lightweight. Save in installation time and labor. Also in building steel with supports and hardware.

Sliding Covers. Strategically located to insure stable mounting base for standard length and facilitate joint makeup and inspection when necessary.

Expert Engineering. Backed by more than 20 years' experience in the design and manufacture of isolated phase bus, insures quick, reliable engineering and excellent delivery.

Self-Cooled or Forced Air Cooled in ratings up to 14,000 amperes continuous.

Let us tell you more about I-T-E Isolated Phase Bus and its installation and operating advantages. Write for Bulletins 10004-A and 10004-B. I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.



Typical assembly with sliding section closed. Closure requires only two 1-piece round lifetime gaskets—easy to place and remove. Simple, powerful V-clamp couplings distribute clamping pressure uniformly around ring.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES LTD.

NEWS-SCOPE

FUTURE NEWS ▶ **Another breakthrough in efficiency of motors** and other rotating apparatus is expected from commercial application of a new cubically-oriented silicon steel. According to Westinghouse Electric Corp and Siemens-Halske scientists, sample cores of the new steel can be magnetized with about 2/3 the magnetizing force required for today's singly-oriented steels.

Electric Companies Public Information Program (handled by Bozell & Jacobs agency) will submit an "electrical progress report" to the New York press at a meeting on Jan. 28 next year.

Pleas are being heard for higher power factor fan motors. Murmers today are reminescent of the early stages of the campaign which raised the power factor of air conditioning units to 90%.

LATE NEWS ▶ **Permission to test watthour meters by statistical sampling** is being sought by New York State utilities. Taking the stand before the Public Service Commission are: Consolidated Edison, Long Island Lighting, New York State Electric & Gas, Niagara Mohawk, Rockland Light & Power, and Rochester Gas & Electric.

Capping a hot electric and gas franchise dispute, Thornton, Colo. (Denver surburb with 10,000 pop.) gives the nod to Public Service Co for the 20-year pact, thus rejecting bid of Union Rural Electrification Assn of Brighton.

Fighting to avert power rationing in Mexico City, Mexican Light & Power has reduced normal voltage 5% and expects to rent a 10,000 kw rail-mounted generating unit from the U.S. Navy soon. Only 250-million cubic meters of water remain in eight dams which have a capacity of 921-million.

Yankee Atomic Electric Co's project faces delay. New England CIO council last week sought a last-minute intervention in the AEC hearing on the company's construction permit application. The labor group will ask for 30 days beyond AEC's 30-day hearing notice. Washington sources hint Yankee's plant will be contested on much the same grounds—safety and financial aspects—as Power Reactor Development Co's Monroe, Mich., project.

Russia plans to produce 210 billion kwhr this year, and over 300 billion in 1960. Under construction or being expanded are over 170 hydro and thermal electric stations, including five 1.2 million kw thermal stations. In the Urals and central USSR, atomic power stations are abuilding with a capacity of over 400,000 kw. Part of this 5-year plan is a united electric power system for the European USSR with a 30 million kw capacity by 1960.

Congratulations . . . Con Ed elects John V. Cleary and R. Frank Brower vps; Emanuel Toder controller . . . Georgia Power makes John W. Lastinger vp, public relations and advertising.

ELECTRICAL WEEK

A TWO-MINUTE

ATOMIC PROGRESS ▶ **Using sawdust as an adsorbent for water containing** dissolved radioactive solids should simplify handling and cut disposal costs. Its adsorption capacity nearly equals that of clay or vermiculite; filter characteristics also are good. Tests have included flow rates of 60 cc per hour and higher with adsorption columns 13 mm in diameter and 18 cm high, demonstrating a decontamination factor of 20 for strontium-90 solution. Sawdust consumption was only 0.6%. Unlike other adsorbents, sawdust can be burned, trimming storage costs **(p 58).**

At least one type of homogeneous reactor would produce power at three times the cost of conventional output, a private study reveals **(p 46).**

AEC claims a Windscale-type accident "couldn't happen" here. Our reactors are water, not air, cooled, and well protected **(p 52).**

EVENTS ▶ **The Windscale reactor incident has exploded into public outcry** and scientific debate. The AEA is under fire for understating the potential hazard before obtaining firm knowledge of it. Many scientists charge the AEA should have carried out its mass evacuation plan, and that there had been earlier fallout **(p 46).**

MEETINGS ▶ **A $600-million U. S. economy will soak up 1 trillion 400 billion** kwhr in 1970, demanding a 310-million-kw capacity—200 million kw more than last year. To create this capacity, electric companies must spend $70 billion by 1970 . . . Residential power sales will not meet the levels forecast for the next few years **(p 51).**

SYSTEM PLANNING ▶ **The coordinated expansion program of seven electric companies** in and near Iowa could save them $140.4 million between 1960 and 1975. The idea: Plan, design, and operate all generation and operation facilities as a single system, thus cutting average capacity costs from $183/kw to $157 **(p 44).**

PROTECTION ▶ **Eliminating clip-lead setups, a new station relay test board** steps up testing rates 50% and eliminates problems of overheating current windings or damaging contacts. Five independent circuits, which may be used separately or in combination, include: Regulated voltage, regulated current, timer and relay trip, three identical resistance load banks, and an insulation tester **(p 64).**

INDUSTRIAL ▶ **Installing adequate relaying systems to protect** and isolate faulty or inadequate equipment has become increasingly important and complex with industry's mounting power consumption. This complexity demands coordination for economic operation. The author weighs the advantages of relays, breakers, selective trips, fuses, and the new combination fused circuit breakers **(p 59).**

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

DISTRIBUTION ▶ **Single-phase service for booming residential air conditioning** and heat pump loads chalked up impressive cost savings over 3-phase service in a recent 8-case study. For existing areas, savings ($536 a customer with a 3-hp air conditioner) were highest at 4% saturation, but decreased as saturation increased. For new areas, meanwhile, total single-phase savings are highest at 25% saturation—$330 a customer with a 3-hp air conditioner, $384 with a 5-hp heat pump **(p 54).**

SELLING ▶ **The "Medallion Home" program,** Live Better Electrically's new all-industry boost to residential power and appliance sales, has already won support of utilities, manufacturers, dealers, and builders. Spearheading the program, some 300 utilities will set area new-home standards for installing appliances, wiring, and lighting, and award medallions to builders who comply. LBE expects the program will go on indefinitely, with 20,000 homes tagged by 1959, and 100,000 by 1960. Other LBE plans center around EEI's appliance promotion calendar, with kits to boost local campaigns **(p 47).**

Like it or not, private and public power companies must work together to meet growing rural loads. Selective load building is important, but prime emphasis must be on capacity **(p 71).**

REGULATION ▶ **In handling savings derived from liberalized depreciation** or accelerated depreciation, F. M. Beatty of Arthur Andersen & Co says deferred tax accounting is the proper technique. This kicked off the first half of a debate before the New York Society of Security Analysts. Donald C. Cook of AG&E replied, however, that it's proper to normalize the credit to a restricted earned surplus account **(p 101).**

PEOPLE ▶ **Pennsylvania Power & Light Co** has advanced Douglas J. Connell to operating vp; P. W. Siekman to vp in charge of general services; John S. Davidson to vp, Scranton division; and C. R. Collyer to treasurer . . . Canadian Electrical Manufacturers Assn has elected Thomas J. Bell president for 1957-58 **(p 114).**

MANUFACTURERS ▶ **Sangamo Electric Co now guarantees** for life all its single-phase and polyphase watthour meters and the watthour meter section of all combination metering instruments . . . Allis-Chalmers and S. Morgan Smith got the nod for their joint $11,083,350 bid on 12 hydraulic pump turbines for the Niagara Power Project **(p 107).**

NEW EQUIPMENT ▶ **Automatic recloser for 46-kv maximum service** has interrupting rating of 4,000 amp for 34.5 kv; and 3,000 amp for 46 kv . . . Cluster-type capacitor rack assemblies minimize pole bending moment, leave ample climbing room, and are easy to mount . . . Sound insulated power transformers in ratings from 10,000 kva up are 97% quieter than previous units **(p 90).**

ENGINEERING TRENDS

Residual slurry consisting of coal fines from a coal preparation plant will be burned in a 60-Mw power plant in Scotland according to "Electrical Review". Slurry contains up to 40% moisture, has the consistency of putty, and an average calorific value of 6,450 Btu per lb.

Alumina-silica and silicon dioxide are not adversely affected by radiation. Because of this characteristic they are highly regarded as insulating material for use in nuclear reactors. The thermal properties of both materials are not greatly changed by exposure to high order neutron and gamma fluxes. Although tests show that there is a 10% reduction in thermal conductivity apparently due to nuclear radiation in the alumina-silica, a recovery to approximately the original value was indicated after a few hours removal from the source of radiation.

Scram relays in nuclear power plants can sense the "real thing" from momentary power failures by the use of a simple capacitor. A capacitor of proper size is paralleled with the series combination of a normally energized voltage scram relay and a normally closed instrument trip contact. For a power interruption within the discharge time of the capacitor there is no drop in voltage and no circuit operation takes place. But for a valid scram signal the relay circuit is interrupted immediately.

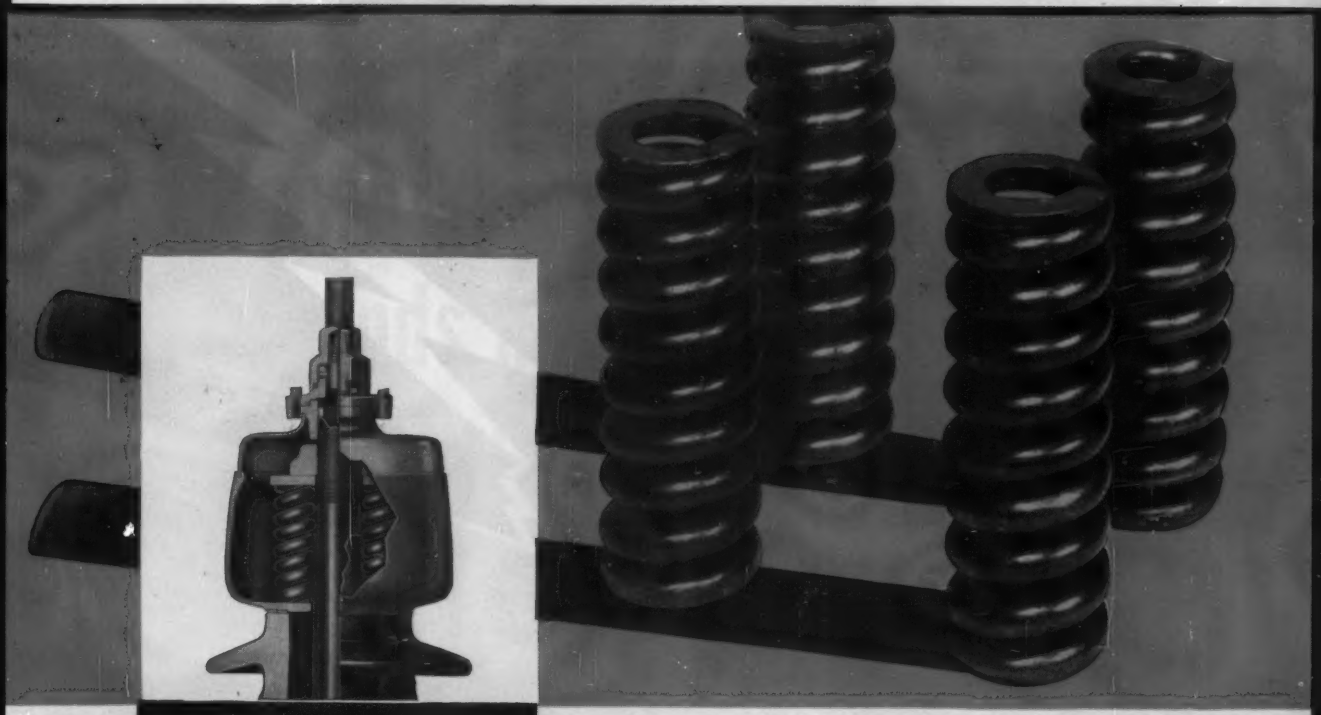
The need for continuous uninterrupted service and a desire to reduce maintenance costs are two reasons high-priced, corrosion-resistant electrical materials are being specified for oil refinery electrical equipment. The overall benefits seem to justify the initially higher cost for construction in such highly corrosive areas as refineries.

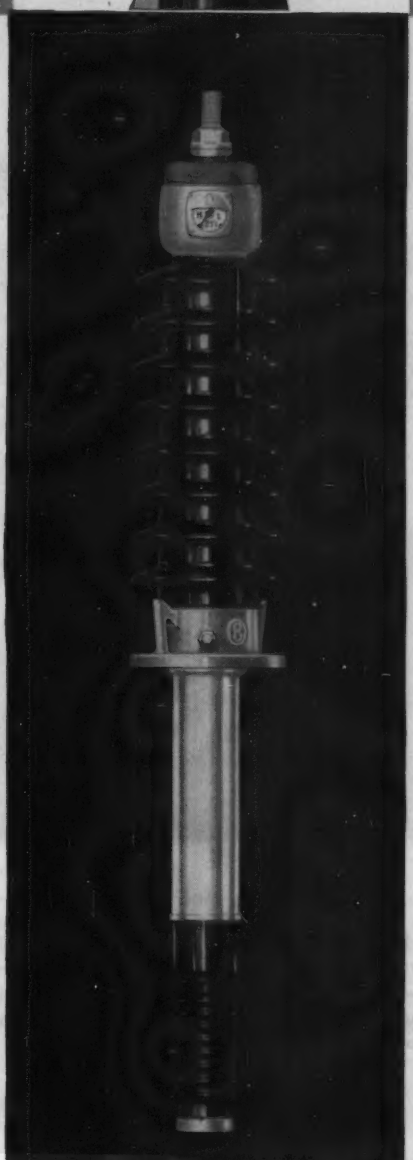
Temperatures of 7,000F have been obtained with a carbon arc and two standard type elliptical mirrors used in motion picture projection equipment. The highly-polished curved mirrors concentrate rays from the carbon arc into a small but extremely high-energy beam. One mirror directs the energy of the arc at the other which in turn concentrates the radiation on the specimen being heated.

Electronic sensing holds promise for the complete elimination of transcription errors. In this technique the characters in the original copy are photoelectrically sensed and recognized and a punched tape is prepared automatically. Excellent results have already been obtained where strict controls can be applied to the original printed copy.

FROM EDITORS IN THE FIELD

Out-leakage can not exceed one lb per day for all equipment in the steam cycle of the Argonne Experimental Boiling Water Nuclear Reactor. In-leakage of atmospheric moisture is limited to ½ lb per day. This is extremely low when compared to conventional plant leakage of approximately 1,000 lb per day.





Why O-B Bushings Stay Tight!

Refinement of assembly method preserves life of compression springs.

There was room for improvement in bushing assembly—improvement on the spring compression principal O-B originally developed. Springs must be steel. This meant danger of magnetic heating in the strong field of a bushing conductor if a single spring surrounded that conductor, as was often the case.

Now, in the new O-B condenser bushing, a nest of springs do the work. All are external to the conductor. There's more safety in numbers, and heating is negligible.

To be sure the springs "stay out of the act" in carrying current, the lower portion of the reservoir where the springs seat is insulated from the central conductor. Thus, another possible cause of trouble has been eliminated.

Such design refinements are typical of the new O-B condenser bushing line. After making bushings for 50 years, we knew where sound refinements were needed.

When you specify O-B bushings for your new apparatus you will be getting the cleanest piece of modern design on the market today. It will pay off in better service.

Ohio Brass

Enlarged drawing of Thermalastic insulation tape. High coil voltage can't get through the fish scale barrier of large mica splittings. The patented *elastic* impregnant expands and contracts with the coil to prevent tape separation; that's the *big difference* between Thermalastic insulation and other types.

Here's why Thermalastic insulation ends major cause of generator and motor failure

LARGE mica splittings have long been recognized as the most reliable coil insulation material, but for years it seemed impossible to find the RIGHT impregnant for the insulation tape.

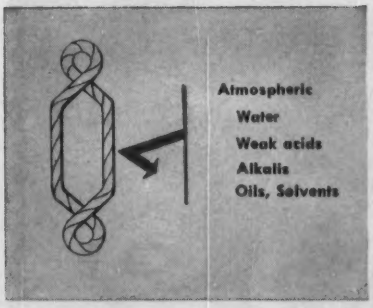
Some were too brittle and others too plastic at high coil temperatures; none could withstand repeated expansion and contraction of the coil . . . and sooner or later, tape separation caused failures.

Then the great discovery — In 1949, Westinghouse research scientists made *Thermalastic*® insulation a reality by discovering the "miracle resins" which cure to a *tough* resilient solid. Large mica splittings, overlapped like fish scales, are locked in this elastic bond which "breathes" . . . expands and contracts with the coil. It doesn't harden or soften with repeated heating by the coil. It doesn't deteriorate with age.

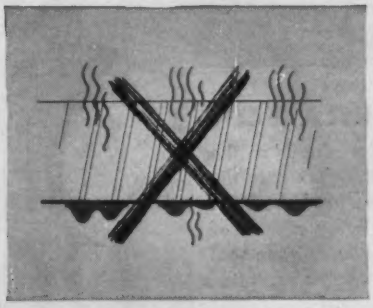
New color movie and bulletin show how and why Thermalastic insulation has extended the life of more than 40 million kva of generators and large motors. Contact your Westinghouse representative or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-15004

YOU CAN BE SURE...IF IT'S

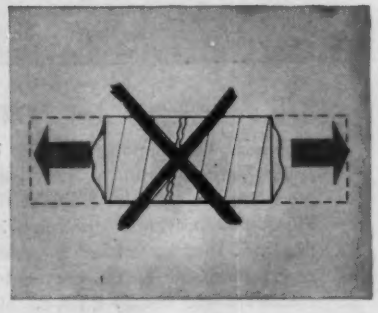
Westinghouse



Withstands attacks
which weaken and finally destroy other insulations. The Thermalastic insulation bond is void-free, has great density, and it's chemically inert. The physical strength of the resilient insulation wall is far greater than that of ordinary insulations.



Doesn't soften or embrittle
The patented resins in Thermalastic insulation are thermosetting . . . heat changes them from a liquid to a permanently elastic solid which doesn't soften or embrittle after repeated heating. And it doesn't deteriorate while in storage or in use.

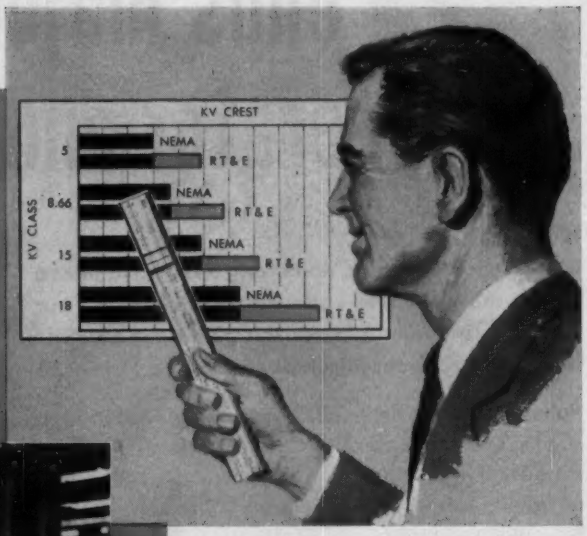


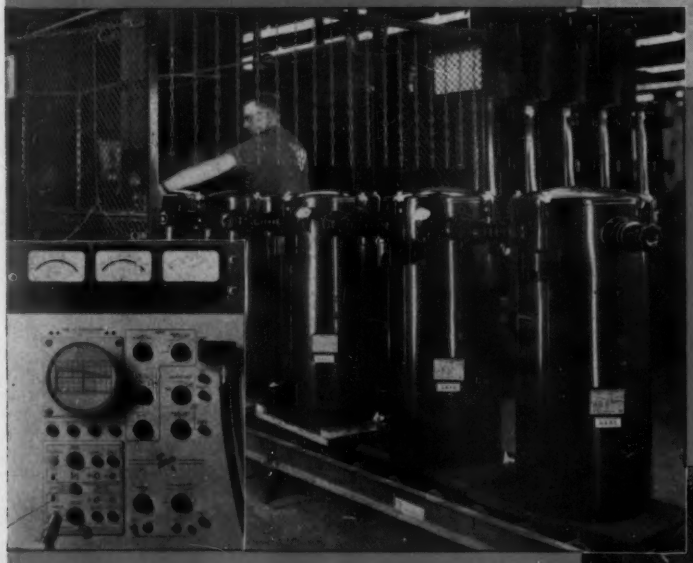
Not stressed
The insulated coil is heated to operating temperature, and *while it's expanded*, the resins cure to an ELASTIC solid. That's why Thermalastic insulation is relaxed when the coil expands, compressed when it contracts. It flexes when the coil is overloaded.

IMPULSE TESTED

DESIGN

High impulse strength in transformers is not attained by accident; it must be considered from the very beginning of design. Such is the case at R T & E, where transformer design is based on impulse withstand levels approximately 50% in excess of NEMA standards.





TESTING

Every R T & E Transformer receives an "on the line impulse test" through use of the most modern equipment and methods known. This test not only insures that the transformer meets NEMA impulse level requirements but also rejects those transformers that are not of maximum quality.

OPERATION

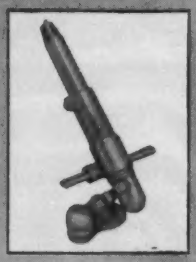
Naturally, the ultimate in testing is provided "on the system", where nature subjects the transformer to the most rigorous tests. R T & E Transformers have been thoroughly proven in operation in every climate of the U. S. They have been awarded the invisible seal of customer satisfaction, proved by a growing list of customers who specify R T & E.

R T & E CORPORATION
WAUKESHA, WISCONSIN

Helping provide power for America

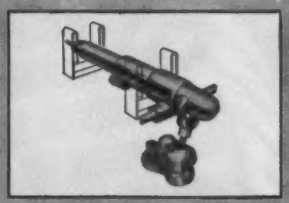
1. SWITCH BLADE IN FULLY OPEN POSITION

Universal link connects blade and crank arm for transmitting forces to the switch blade for full cycle of operation.



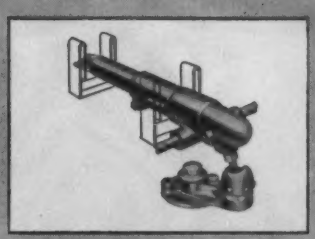
2. SWITCH BLADE CLOSING

Switch blade is moved from the open to closed position by a relatively small angular motion of the crank arm.



3. SWITCH BLADE ENTERS CONTACTS

In this position the switch blade begins its rotation for full contact engagement. Continued movement of the crank arm will rotate the blade to bring contacts under high pressure.



4. SWITCH WITH CONTACTS FULLY ENGAGED

The simple linkage of the WAG concentrates mechanical advantage so that contact engagement or disengagement is accomplished with a minimum of effort.

Simple WAG linkage boosts mechanical advantage; lessens operating effort

In one sweeping, continuous movement the Type WAG Switch blade swings into the open or closed position. There is no lost motion — no cams, triggers, or latches.

The WAG is operated by a simple system of cranks and levers arranged to transmit maximum torque when the blade rotates to engage or disengage the contacts. By concentrating mechanical advantage where it is needed most, the WAG can be operated smoothly and with less effort.

Thus, the Type WAG offers the advantages that engineers recognize as so important: a switch easy to operate, higher contact pressure, and wider contact deflection. The Type WAG has the muscle to break up heavy concentrations of ice and to operate dependably under the most adverse conditions.

For a premium quality switch capable of long, reliable service, choose the Type WAG.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

How many generators to

produce 24,000,000 kw ?

About 22,000—so far. That is the number of generators Electro-Motive has built during the past twenty years, for a total generating capacity of more than 24,000,000 kw.

As a leading manufacturer of electrical equipment, Electro-Motive has not only produced thousands of generating units, but in the process, has also contributed materially to "improving the breed." Electrical engineers at Electro-Motive are continuously experimenting with new design improvements, new processes that result in more efficient, longer-lived units.

It is this background of experience in production, design and research that stands behind Electro-Motive power equipment. It is your assurance of dependability, economy and long life under the difficult applications of low load factor generation for which they were designed. Why not ask your Electro-Motive representative for additional information?

1000 kw units for use on sidings or placed on piers for semi-permanent use.

500 kw units offer excellent mobility for many temporary applications.

LIVE BETTER ELECTRICALLY

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

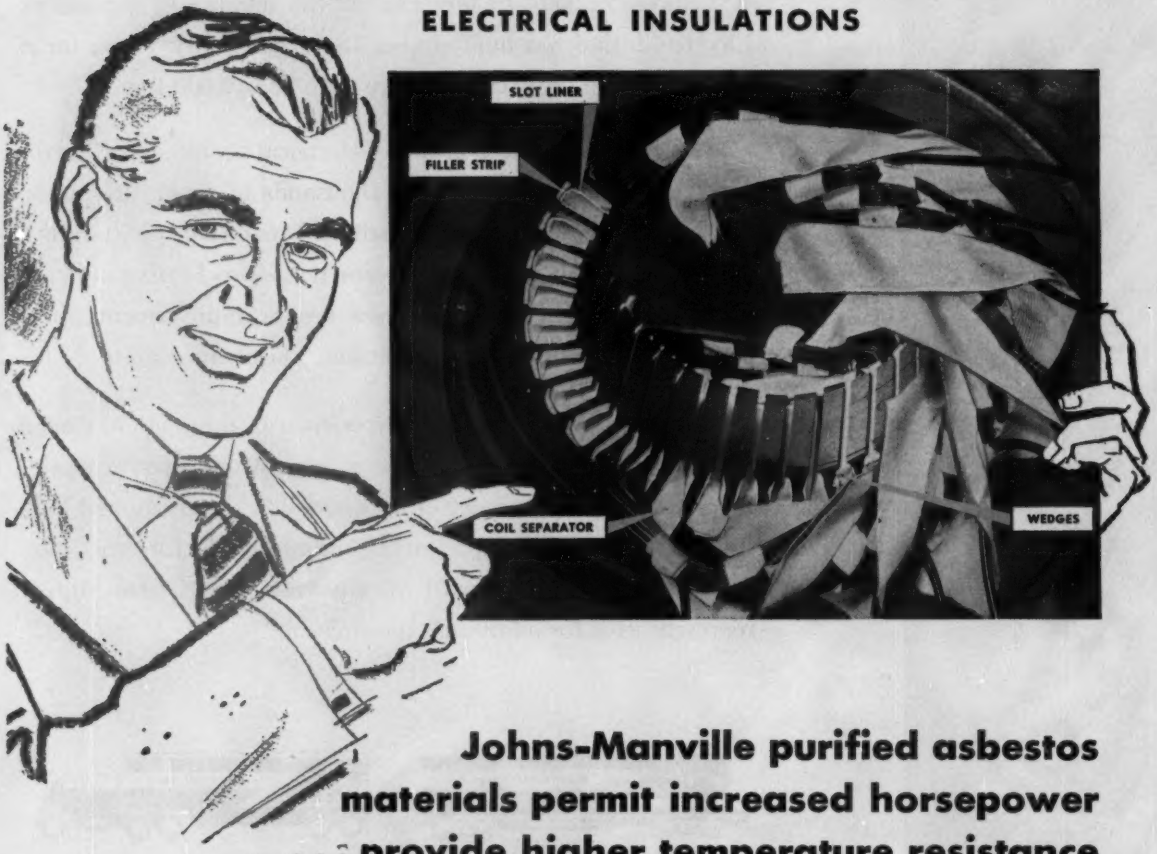
LA GRANGE, ILLINOIS

Sales offices in Chicago, New York, St. Louis, San Francisco
In Canada: General Motors Diesel, Limited, London, Ontario

Smaller motors carry bigger loads when you insulate with

Quinterra®

ELECTRICAL INSULATIONS



Johns-Manville purified asbestos materials permit increased horsepower . . . provide higher temperature resistance

MOTORS insulated with Quinterra will outperform others of substantially higher rating but with less heat-resistant insulation.

The above photograph shows how you can use *Quinterra* and its companion product *Quinterrabord*® on a standard Class H induction motor. *Quinterra* Type 3-GR was employed for slot liners and coil separators. Wedges and filler strips are of *Quinterrabord* Type 3. Both materials are made from highly purified asbestos fibres treated with silicone resin for the highest combination of dielectric strength and pyrolysis resistance obtainable. In addition, Type 3-GR is reinforced with a strengthening layer of fine glass cloth.

Johns-Manville has developed a complete line of *Quinterra* materials for application in motors, transformers and other electrical apparatus. For further information write for brochure EL-40A. Address Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS

Outdoor Station

features

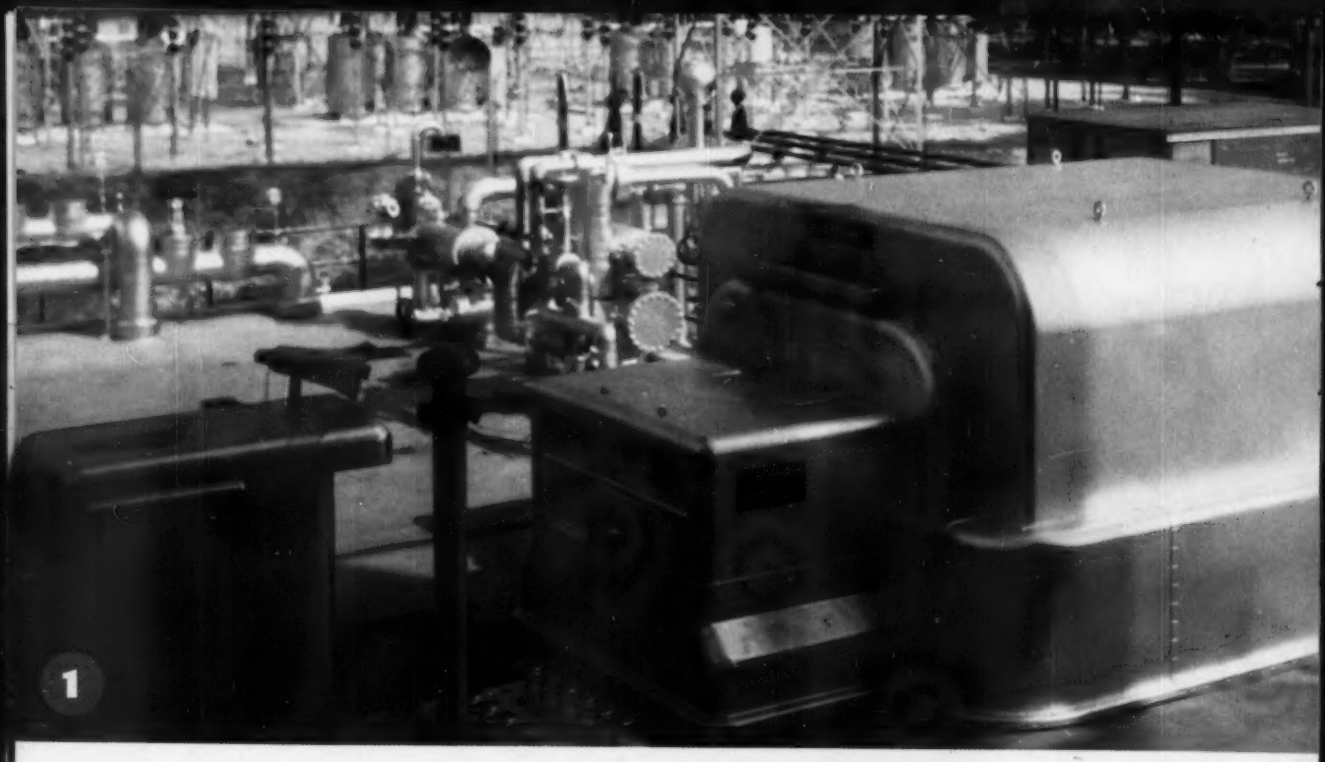
Wide Range of Allis-Chalmers Equipment

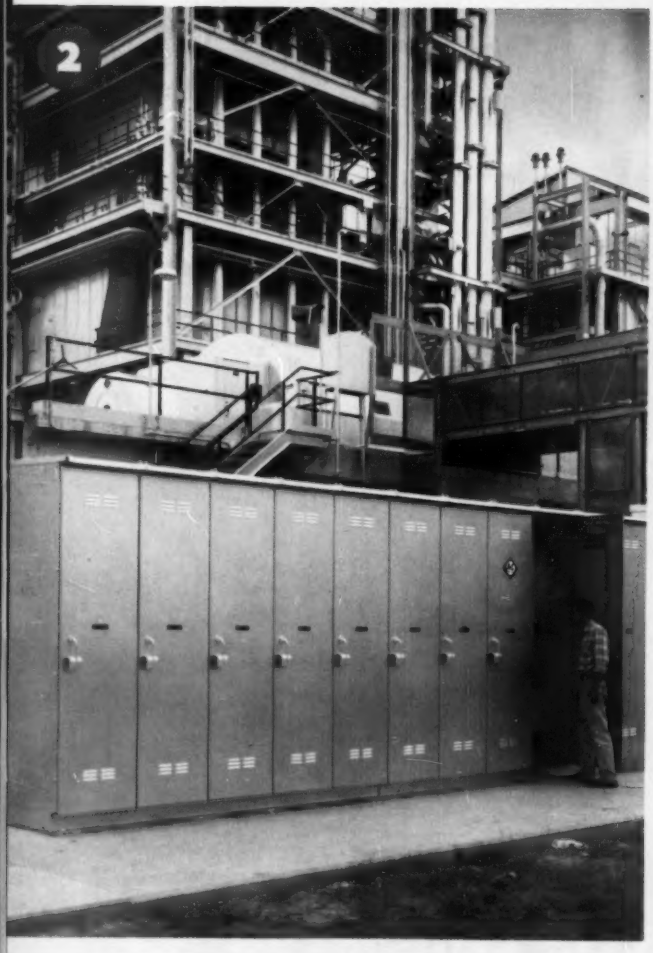
Here's the new addition to the Palatka Station of Florida Power and Light Company, which was engineered and constructed by Ebasco Services Incorporated. This new power station symbolizes the growth, the drive, the fresh modern look that is everywhere in sunny Florida today. It also offers testimony to the close coordination and planning between engineers from the utility, Ebasco, and Allis-Chalmers on a wide range of problems.

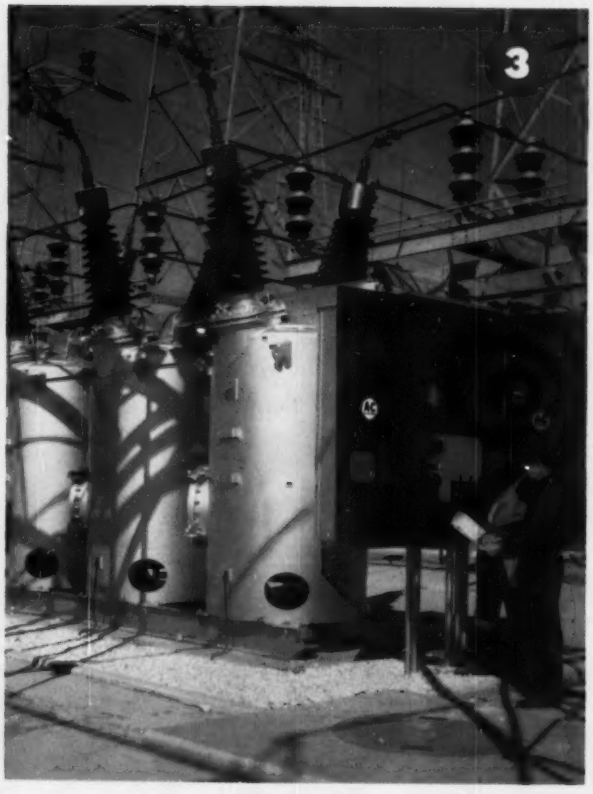
A-5361

Palatka Station

ALLIS-CHALMERS







A-C ALLIS-CHALMERS ALLIS-

1. At the heart of things is the 62,500-kw outdoor steam turbine generator unit, featuring permanent side-crossunders between high and low pressure tandem turbines, steam valves below deck, supercharged generator with direct hydrogen-cooling of rotor copper, and commutatorless excitation system with inherent rapid-response voltage regulation. Units to 220,000 kw are in production by Allis-Chalmers for outdoor stations.

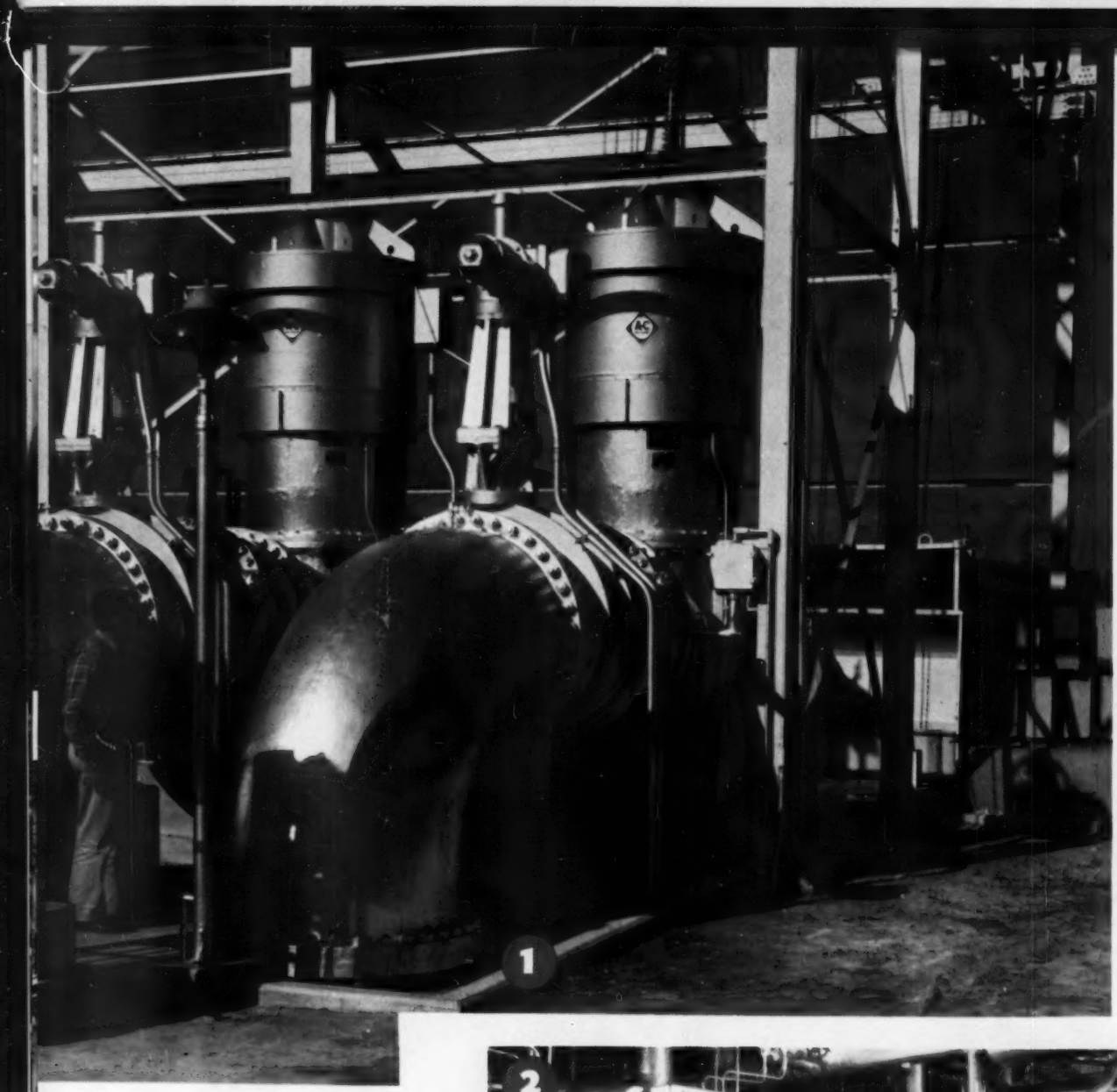
2. Switchgear — Allis-Chalmers 2400-volt and 480-volt outdoor weatherproof switchgear controls major station auxiliaries.

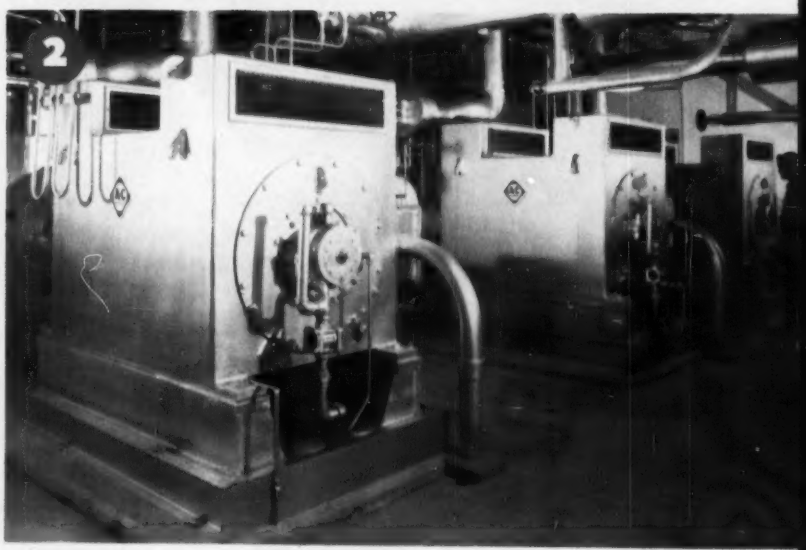
3. Circuit Breakers — *Pneu-Draulic* operators and mechanically trip-free operation are features of three 115-kv Allis-Chalmers circuit breakers.

4. Transformers — This 85,000-kva forced oil cooled power transformer is for main step-up service to the 115-kv lines.

Pneu-Draulic is an Allis-Chalmers trademark.

CHALMERS





1. **Pumps-Motors** — Shown above are two vertical weather-protected motor-pump units furnished by Allis-Chalmers.

2. **Control Centers-Motors** — For boiler feed pumps; induced and forced draft fans were furnished by Allis-Chalmers.

For the complete story on *all* the products Allis-Chalmers builds for electric power generation, distribution and utilization, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

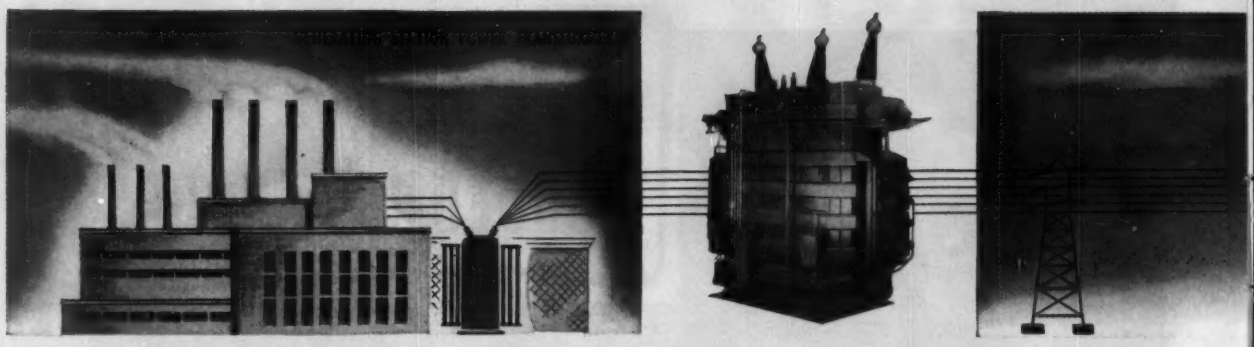
Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.

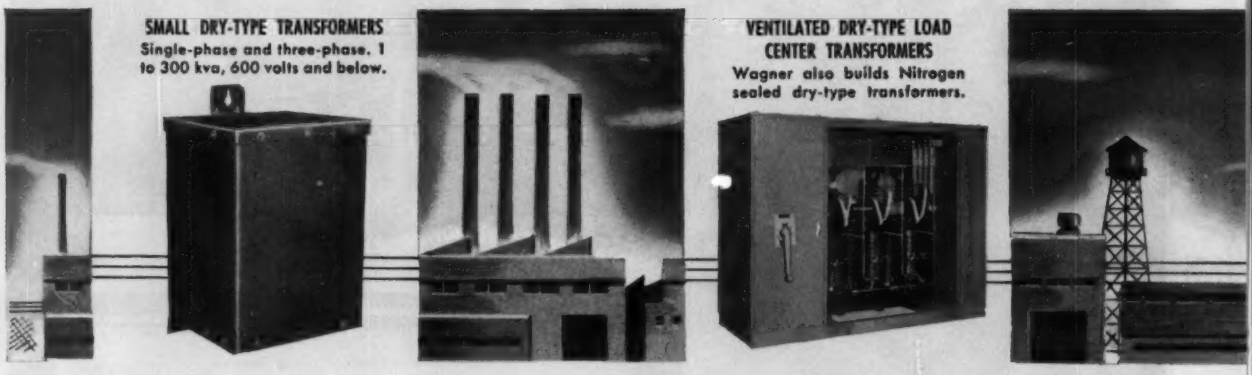
OTHER *Electroline* PRODUCTS

Electroline Company

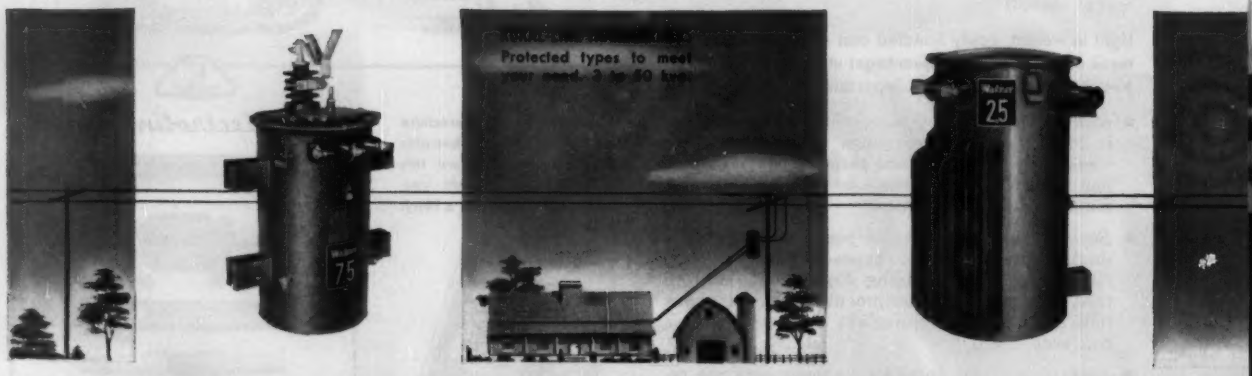
4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO



WAGNER TRANSFORMERS


SMALL DRY-TYPE TRANSFORMERS
Single-phase and three-phase. 1 to 300 kva, 600 volts and below.
VENTILATED DRY-TYPE LOAD CENTER TRANSFORMERS
Wagner also builds Nitrogen sealed dry-type transformers.

Central Station - - Industrial - -



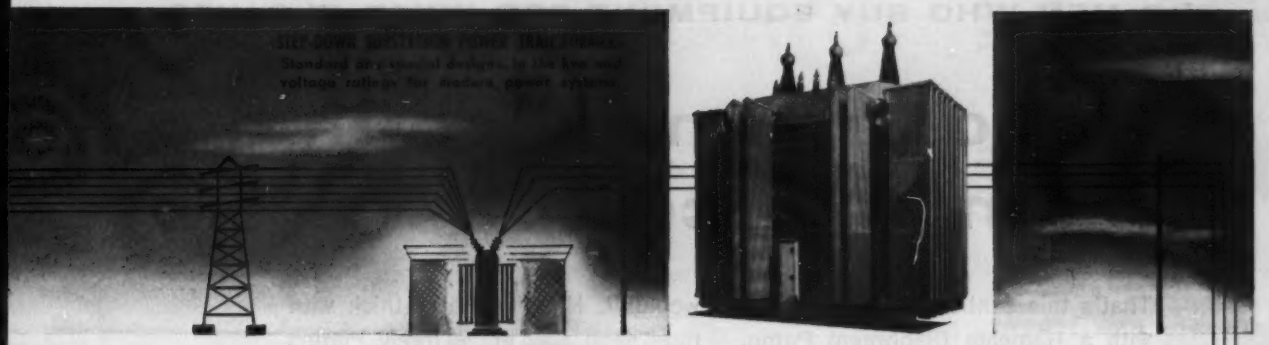
ENGINEERED FOR LONG

T57-14

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

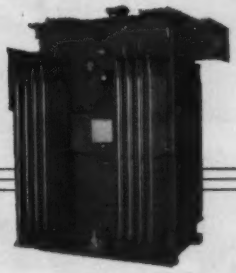
BRANCHES AND DISTRIBUTORS
IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS • TRANSFORMERS •

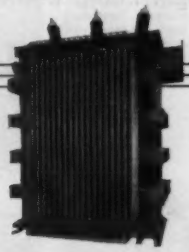


FOR EVERY NEED . . .

UNIT SUBSTATION TRANSFORMERS
Oil-filled and Noflamol (non-inflammable liquid)-filled.

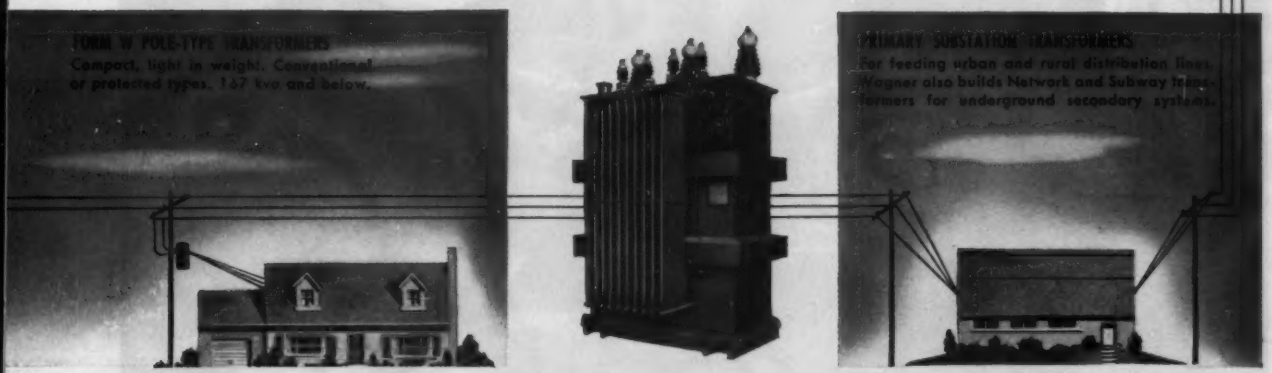


INDUSTRIAL SUBSTATION POWER TRANSFORMERS
Medium sized transformers built to ASA Standards C57.12b.



Transmission - - Distribution

FORM W POLE-TYPE TRANSFORMERS
Compact, light in weight. Conventional or protected types. 167 kva and below.



PRIMARY SUBSTATION TRANSFORMERS
For feeding urban and rural distribution lines. Wagner also builds Network and Subway transformers for underground secondary systems.

DEPENDABLE SERVICE

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U.S.A.

LIVE BETTER ELECTRICALLY

INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR & HYDRAULIC

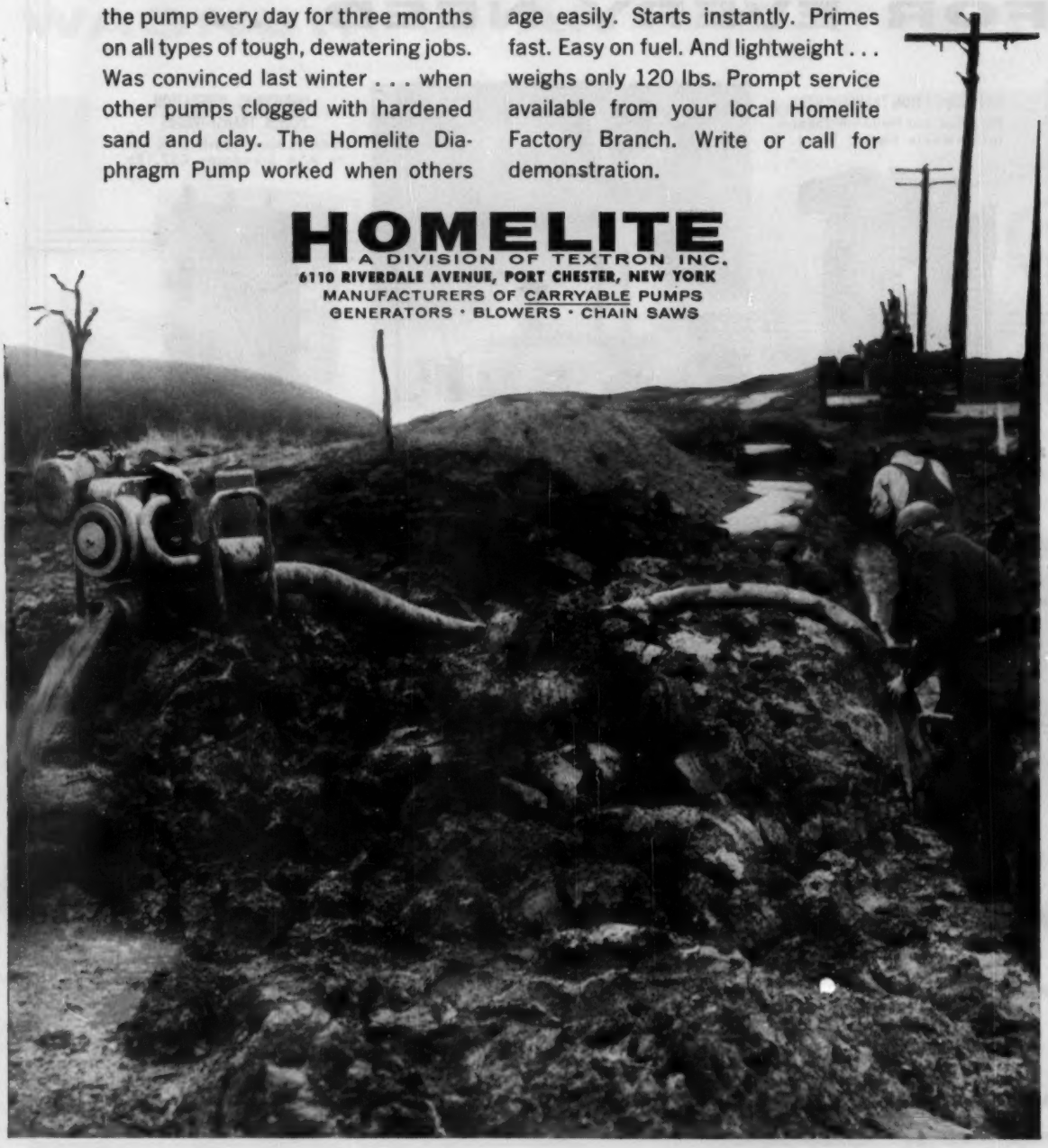
FOR MEN WHO BUY EQUIPMENT FOR WHAT IT SAVES

"Not one dime's worth of maintenance"

Mr. Joe Cloghessy, Pres
T. F. Cloghessy, Inc.
Hammond, Ind.

That's this contractor's cost record with a Homelite Diaphragm Pump. Zero for maintenance . . . and he used the pump every day for three months on all types of tough, dewatering jobs. Was convinced last winter . . . when other pumps clogged with hardened sand and clay. The Homelite Diaphragm Pump worked when others wouldn't. Handles water thick with mud, sand, clay, gravel freely. Pumps 5,000 gals. per hour. Handles seepage easily. Starts instantly. Primes fast. Easy on fuel. And lightweight . . . weighs only 120 lbs. Prompt service available from your local Homelite Factory Branch. Write or call for demonstration.

HOMELITE
A DIVISION OF TEXTRON INC.
6110 RIVERDALE AVENUE, PORT CHESTER, NEW YORK
MANUFACTURERS OF CARRYABLE PUMPS
GENERATORS · BLOWERS · CHAIN SAWS



3 Legs Make Twice the Derrick

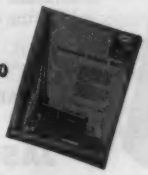
With Holan's three-legged derrick, you are ready for any job at a moment's notice... butt-pulling... body-loading... extra-heavy lifts.

The integral third leg means crews won't have to sit idle while a separate third leg is being attached. And the integral third leg gives extra strength to provide a wider and safer working range.

This derrick was designed to do more than it has to. It lifts loads up to 12,000 pounds, poles 75 feet long . . . and has been load-tested at 22,000 pounds. For body loading, it hoists up to 5,000 pounds of equipment over the rear axle. Working range is 195° — the derrick head lowering to within five feet of the ground. Two levers at the rear of the truck body hydraulically control the derrick and live boom.

There's nothing else in the field like Holan's Series 3700 Live-boom Power Derrick.

Write for the Series 3700 catalog.



J.H. HOLAN CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11, OHIO

OTHER PLANTS:
HOLAN CORPORATION OF GEORGIA, Griffin, Ga. • J. H. HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 72", 75", 84", 90" and 102".

Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

Portable hydraulic and mechanical earth borers. Augers for 8" to 20" diameters, depth to 8'.

Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

You get *Versatility* in BLACKBURN'S PermaCad Aluminum Fittings

CHECK THESE PLUS FEATURES

- All fittings may be used on either aluminum or copper conductors. Each fitting accommodates a wide range of wire sizes—few fittings are needed in stock or on trucks.
- Installation errors are eliminated on bi-metallic connections. Either groove will accommodate aluminum or copper conductors.
- Permacad fittings are available in one or two bolt parallel groove clamps—single and double U-bolt clamps. There's a fitting for every job.
- Grooves are contoured to surround conductor and provide large contact areas . . . improving conductivity.
- Non-copper-bearing, heat treated aluminum alloys used in all castings. Hardware available in either hot dipped galvanized steel or high strength aluminum alloy. Bolts alumilited to prevent seizing.

* **PERMACAD** *is a complex, heavy duty plating of cadmium and other metals which has exceptionally long life. PERMACAD protects aluminum because of its favorable electrogalvanic potential and is highly resistant to galvanic corrosion when in contact with copper.*

PGP SERIES
One bolt parallel groove clamp. Three fittings accommodate wire ranges from 8 AWG to 397.5 MCM.

PGP 400 SERIES
Two bolt parallel groove clamp. One clamp accommodates conductors from 1 str to 400 MCM.

DLC GP SERIES
Single U-bolt clamp. Four clamps accommodate wire range from 6 AWG to 266.8 MCM.

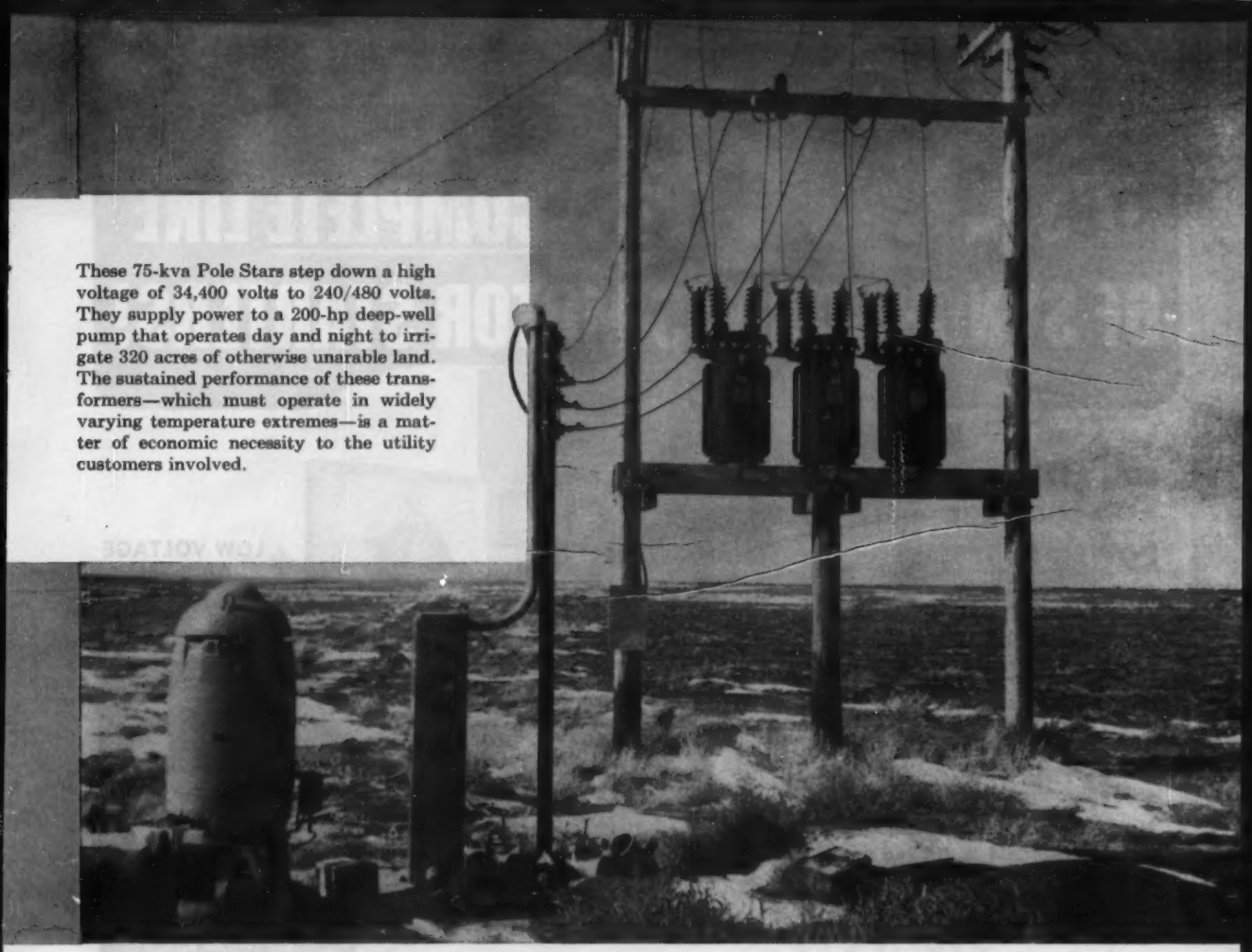
2U GP SERIES
Double U-bolt clamp. Six clamps accommodate conductors from 1 str to 397.5 MCM.

BLACKBURN PermaCad FITTINGS

IMPORTANT: We recommend the use of CONTAX on all aluminum and bi-metallic connections. CONTAX is an oxide inhibiting compound with an ASTM drop point in excess of 500° F.

AVAILABLE THROUGH ELECTRICAL DISTRIBUTORS EVERYWHERE

JASPER BLACKBURN CORPORATION
1525 WOODSON RD., ST. LOUIS 14, MO.
WYdown 3-9430



These 75-kva Pole Stars step down a high voltage of 34,400 volts to 240/480 volts. They supply power to a 200-hp deep-well pump that operates day and night to irrigate 320 acres of otherwise unarable land. The sustained performance of these transformers—which must operate in widely varying temperature extremes—is a matter of economic necessity to the utility customers involved.

You Get "Power Transformer Ruggedness" in High Voltage Pole Star Distribution Transformers

With wide experience in the design and construction of power transformers, Pennsylvania Transformer has the specialized knowledge and skill needed to satisfy the rigorous demands of high voltage transformer applications. The internal ruggedness that typifies Pennsylvania's power transformers also is designed into higher voltage Pole Star Distribution Transformers.

For example, the sturdy high voltage lead supports form an integral part of the coil . . . coils have extra bracing top and bottom to protect against possible short circuit forces . . . the core frame is of especially sturdy angle-and-channel construction . . . and tap changers feature power transformer ruggedness in both design and construction.

As a result, high voltage Pole Stars deliver economical, sustained performance in even the most demanding distribution transformer applications. The pictured 34,400-volt installation is a convincing example. For more details contact Pennsylvania Transformer Division, McGraw-Edison Company, P. O. Box 330, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA POLE STAR TRANSFORMERS

PENNSYLVANIA DISTRIBUTION TRANSFORMERS

IT'S EC&M FOR A COMPLETE LINE OF SYNCHRONOUS MOTOR STARTERS!

FOR ALL LOW VOLTAGES AND FOR 2200-4800 VOLT POWER SYSTEMS!

Here's Why EC&M Pushbutton Automatic Starters Do The Job Better...

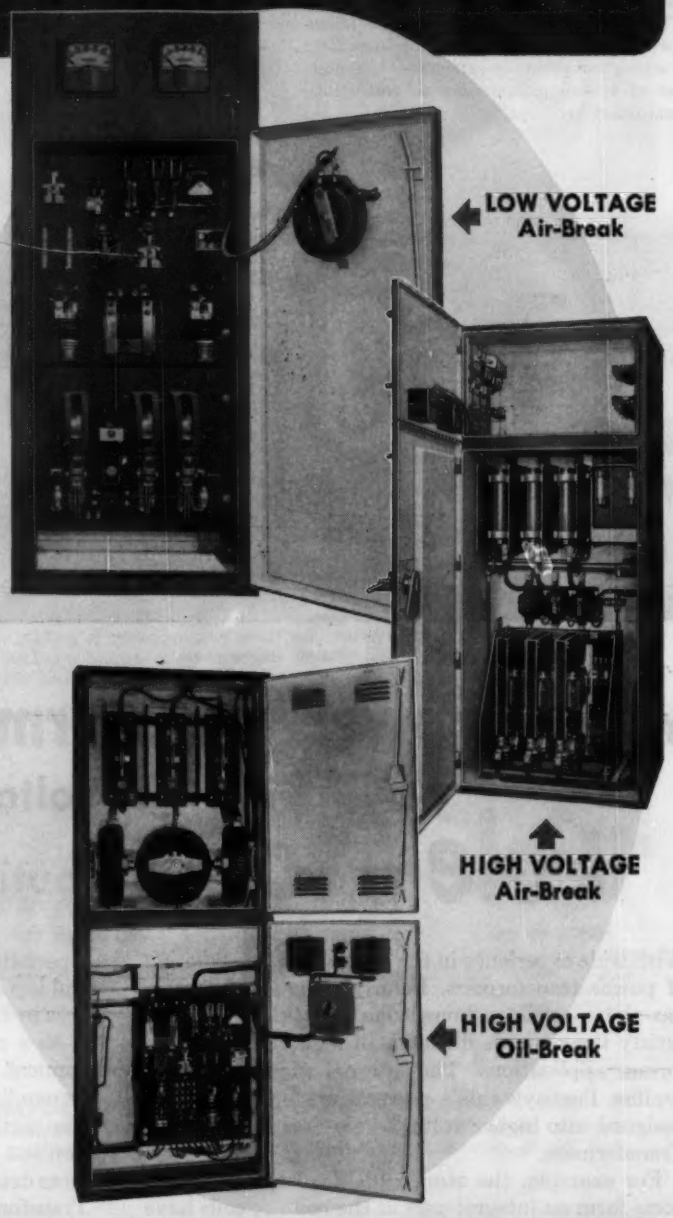
Complete protection during starting, acceleration and while running at synchronous speed.

Motor pulls into step without delay because field is applied under best conditions for synchronization.

Automatic field removal and re-synchronization allow motor to accelerate and re-synchronize after voltage dip or momentary overload.

Easily installed because all internal wiring is complete.

Full or reduced voltage starting All high voltage starters available in 3 ratings: (*1*) 50,000 KVA (certified) interrupting capacity—(*2*) with power-type, current-limiting fuses —(*3*) VALIMITOR® (volt-ampere-limitor), the bus may be of unlimited KVA.



Write for Bulletins 8200 and 8820

THE ELECTRIC CONTROLLER & MFG. CO.
A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 • OHIO

8587

GIVE-AWAY ...WITH STRING ATTACHED

Although many people are far too smart to fall for the old "lost wallet" trick, some still fail to see the string on the "public power" give-away. The time-honored April Fool stunt can only snatch away some money that the victim never had. "Public power" lifts his hard-earned cash right from his pocket.

What makes the "public power" issue much more insidious is the claim that the whole idea is to *prevent* a give-away: the giving away of power sites—natural resources that belong to everybody—to private power companies. The government, say "public power" advocates, can sell power much more cheaply.

And it does. Not that the government *produces* it for less—it has to pay the same costs of labor, tools, and materials that any private power company would have to pay.

But here's the string: Government power agencies are largely exempt from taxes. So are the investors in their securities. The savings in direct tax costs and finance charges enable these agencies to charge much lower rates for electric power and still show no deficit on their books.

Who then makes up the difference between what "public power" really costs and what the favored consumers pay for it? The public at large, the *taxpayer*.

Thus, for each $1 paid for electricity by customers of a private power company, some 23¢ goes for taxes. But people who buy their power from TVA, for instance, get off with taxes of only about 4¢ on the dollar.

So where's the give-away?

It occurs not under private enterprise but under "public power" development as practiced today.

The thing that's given away is not natural resources but the taxpayer's money.

And the favored groups are not private power companies but customers of "public power."

One question: Why shouldn't every American pay his fair share of taxes?*

*Based on material from The Guaranty Survey, published by Guaranty Trust Company of New York.

Leaflets, reprints and newspaper mats available at cost for publication of this message locally over the signature of your company. Address EW-2, Guaranty Trust Company of New York, 140 Broadway, New York 15, for further information.

GUARANTY TRUST COMPANY OF NEW YORK

140 BROADWAY, NEW YORK 15

Capital Funds in excess of $400,000,000

Fifth Ave. at 44th St., New York 36 · Madison Ave. at 60th St., New York 21
40 Rockefeller Plaza, New York 20 · London · Paris · Brussels

Member Federal Deposit Insurance Corporation

PREFORMED ARMOR RODS
increase uninterrupted service life of conductor

The wind blows, the conductor vibrates and the life of your line is at stake. If the vibration problem is such that severe frequency and amplitude conditions are sufficiently prolonged, the conductor could begin to break regardless of the protective armor used. And, if the conductor begins to break, PLP Preformed Armor Rods have a big advantage over other armor. The rods undertake the function of an electrical and mechanical repair splice.

All armor rods greatly reduce vibration stresses, but if vibration is severe enough to cause strand breaks, other types will not prevent parting of the strands. With PLP (short pitch) Preformed Armor Rods, it's a different story; the conductor is held tightly and uniformly throughout the entire length of the rods—not at one point. You have a long, firm grip that never relaxes, that maintains conductivity in spite of the break. Thus, your line continues to function unimpaired.

There is one other Preformed advantage to keep in mind. Some types of armor require the use of bolted end-clamps that can shake loose and cause chafing. Preformed Armor Rods require no end-clamps.

For a long uninterrupted service life, Preformed Armor Rods are the best suit of armor your conductor can wear. PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . In 10 years the leading manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

PLP

You can look up to **Preformed**

Made in accordance with or for use under U. S. Patent Nos. 2,609,653; 2,275,019 and 2,587,521. Other patents pending.

Iowa Southern Utilities gets life-of-turbine guarantee against turbine oil worries

Utility installs NONPAREIL Turbine Oil in two units at Eddyville station

On September 20, 1953, two Westinghouse 20,000 kw. turbines were installed in Iowa Southern Utilities' Eddyville station. Two guarantee certificates, covering the two 1,200 gallon fills, were issued to the utility by Standard Oil. These certificates guarantee Iowa Southern Utilities that for the life of these turbines, the NONPAREIL Turbine Oil will never exceed an acidity level of 0.15 mg. KOH/g. The utility can depend upon the level being much lower—usually on the order of 0.03-0.05 mg. KOH/g.

The significant point to this story is that it is so routine. Iowa Southern Utilities has been installing NONPAREIL Turbine Oil in turbines since 1942. In the years since then, all turbines in the system have been converted to this oil. The oil is backed up with a life-of-turbine guarantee.

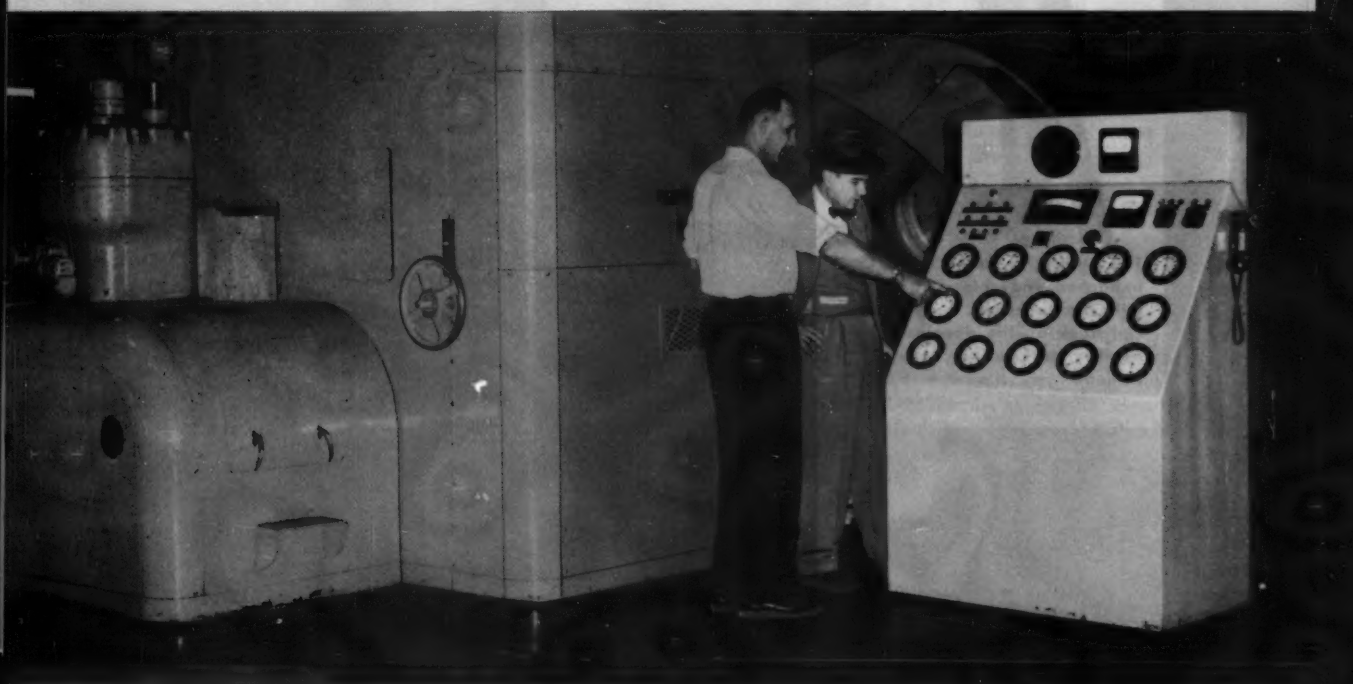
Having an oil with such a guarantee permits Iowa Southern management to direct its attention to the operation of its properties without worry about turbine oil performance. Additional facts about NONPAREIL Turbine Oil are available from your nearby Standard Oil industrial lubrication specialist in any of 15 Midwest and Rocky Mountain states. Call him, or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

L. V. Hults and Jess Nelson inspect turbine oil returning to filter. Mr. Hults said, "The oil looks like new, and we've used it for four years."

Mr. L. V. Hults, Plant Superintendent (left), and Standard Oil industrial lubrication specialist, Jess Nelson, check instrument panel on one of Westinghouse turbines at Eddyville station. Jess Nelson is indeed qualified to serve accounts such as this utility. Jess has an engineering degree from the University of Iowa. He has completed the Standard Oil Sales Engineering School and has four years experience providing lubrication technical service.

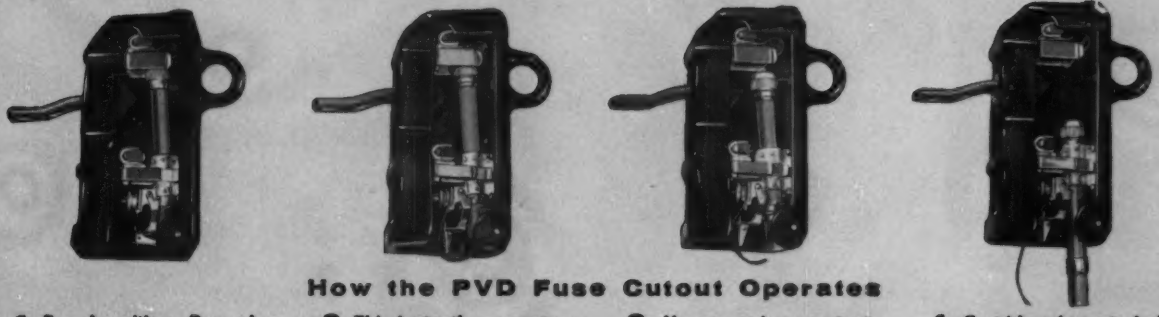
STANDARD OIL COMPANY
(Indiana)

STANDARD



DOOR IS EASY TO OPEN. Handle is high up on the door to assure good leverage, and hole is large enough to insert hookstick easily, yet small enough so hook will not slide down or jump out. Available in standard-duty ratings and new heavy-duty interrupting ratings of 5000 amps. at 5.2 kv and 8000 amps. at 2.6 kv.

THE DOOR IS REMOVED, unhooked, and replaced, all with the hookstick. A special hook on the door assembly makes this convenient.



How the PVD Fuse Cutout Operates

1. Fused position. Door always closed—operation is independent of door. As the link blows, spring-loaded lever flips out the fuse link leader—fast!

2. This instantly separates blown link parts, clearing the arc inside the tube. It also releases a latch which permits the bright yellow fuse tube to drop out.

3. Upper spring contact pushes the tube down and follows it part way, giving extra time to clear the arc, and eliminating burning of contacts. Action is positive.

4. Cartridge drops to indicating position easily seen from the ground. Large air gap prevents re-establishing the arc. No leakage, no radio interference.

How L-M's Famous PVD® Cutouts Provide Faster, Safer Operation

Positive dropout operation provides indication easily seen from the ground. For re-fusing, door is easily removed and replaced with hookstick; high-pressure silver contacts insure long life. Now also available in heavy-duty designs.

By **GEORGE W. COOPER**
Product Manager
Protective and Power
Switching Equipment
Line Material Industries

When a fuse blows in L-M enclosed dropout cutouts, a latching lever flips out the fuse and permits the cartridge to drop to indicating position. Upper contact spring follows tube part way, giving extra time to clear arc inside the tube. Contact spring also provides a downward thrust on the tube to assure positive dropout operation.

The large air gap which results between the tube and the upper contacts on the box prevents re-establishing of the arc. This assures long service, eliminates leakage and possible radio interference. Door remains closed following fuse operation; parts are always protected.

Positive Low-Resistance Contact

L-M's silver-plated spring contacts and round blade provide a very high-pressure, multi-point contact surface. In addition to the side contact clips, the spring-top clip provides additional contact and current path.

L-M's heavy contact construction provides ample metal to conduct heat away rapidly from the multi-point contact surface. This results in cool operation, and resistance is kept low.

Blown Fuses Easily Located

When the cartridge in L-M's enclosed cutout is in indicating position, it is easily seen from the ground—from any angle. The lineman locates the blown fuse quickly; thus he saves operating time and restores service faster.

Easy To Re-Fuse With Hookstick

The pull ring handle on L-M's PVD cutouts is high up on the door to assure good leverage when operating the door. This, plus a hook on the flipper assembly, make it easy to open and unhook the door, and to replace it with a spare fused door, the whole job being done with the hookstick . . . in just a few seconds.

In the open position, all parts of the door and cartridge assembly are electrically dead.

When the door is closed, the two hinges and the lower contact hold the door and cartridge assembly firmly. This, plus the guiding action of the top contact, assures that the door will close properly every time.

L-M Family of Dropout Indicating Cutouts

Interrupting Capacity Amp.	5.2/2.6 kv		7.8 kv	
	50 Amp.	100 Amp.	50 Amp.	100 Amp.
2000/3000	PVD			
3000/5000		PVD		
5000/8000	PHV*	PIV*		
2000			PVD	
3000				PVD

**New heavy-duty ratings*

In addition to the dropout indicating cutouts above, L-M offers a complete line of non-dropout indicating and non-dropout fuse cutouts.

Ask your L-M Field Engineer for more complete information, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ont.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
fuse cutouts and fuse links

L-M's obround transformer is small, light, and has short moment arm distance from the pole. Total bending moment is greatly decreased and potential capacity of all your transformer structures is increased. Good regulation, high overload capacity and other Round-Wound characteristics have been fully maintained in L-M's obround design.

L-M's Obround Design Provides Less Bending Moment On The Pole

By D. A. MANNING
Assistant Product Manager
Transformers
Line Material Industries

L-M's exclusive obround transformer provides a smaller tank with less transformer oil, resulting in a light, easy-to-handle transformer. The obround design also brings the center of gravity of the transformer closer to the pole. The combination of light weight and short moment arm substantially reduces the total bending moment on the pole, and thus greatly increases the potential capacity of all your transformer structures. This advantage was accomplished without changing the outstanding performance characteristics of the Round-Wound® design.

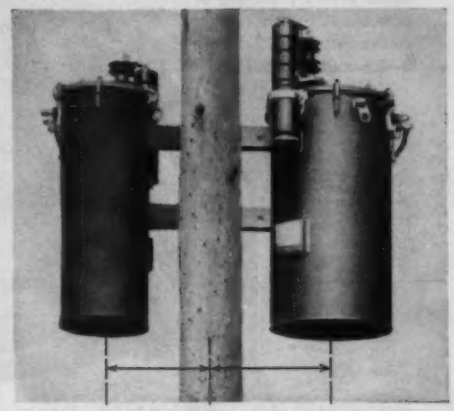
A comparison with four other major makes shows that the low bending moment of L-M's obround design is exceeded by as much as 50%. See the chart.

COMPARE Percent Bending Moment for All Five! See why more customers are selecting L-M obround transformers.

RATING	MANUFACTURER				
2400/4160 Y Voltage	Percent of L-M Bending Moment				
	LM	A	B	C	D
25 KVA	100%	110%	123%	133%	128%
50 KVA	100	123	113	142	120
100 KVA	100	123	115	137	132
167 KVA	100	105	093	115	091
7200/12470 Y Voltage	LM	A	B	C	D
25 KVA	100	131	124	149	126
50 KVA	100	123	110	150	119
100 KVA	100	119	122	149	125
167 KVA	100	107	087	112	089

In addition to reducing the bending moment for equivalent transformer ratings, you can now hang transformers of larger capacity on a pole structure and take advantage of savings such as these:

- Single-pole, three-phase transformer structures can now hold three 50 kva obround transformers instead of three 37½ kva round tank transformers. Thus you obtain 33⅓% more capacity and 15% less bending moment on the pole, and eliminate the need for a costly two-pole structure.
- Three 167 kva obround transformers can now be installed on a two-pole structure, obtaining 67% more capacity and less bending moment on the pole than with three 100 kva older-design transformers.



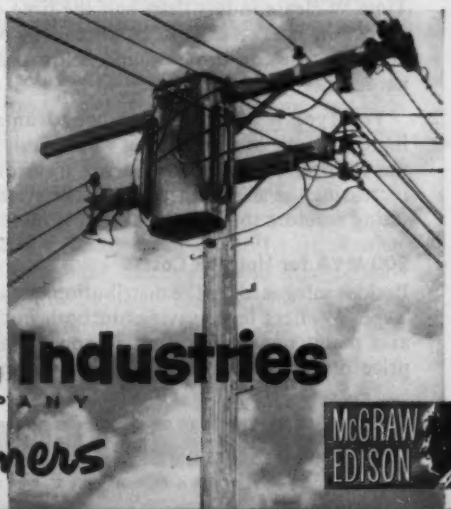
Comparison of these two 25 kva transformers shows how much closer the center of gravity of the obround design is to the pole than with the round design. The result is less bending moment on the pole.

Round-Wound Performance

An outstanding fact to consider on the L-M obround transformer is that, unlike the extremely light transformers of some manufacturers, there has been no sacrifice of performance characteristics. The obround retains all the outstanding performance characteristics of L-M's Round-Wound core-coil design. These characteristics include low exciting current, low noise level, high impulse strength, high short-circuit strength, high short-time overload capacity and many others.

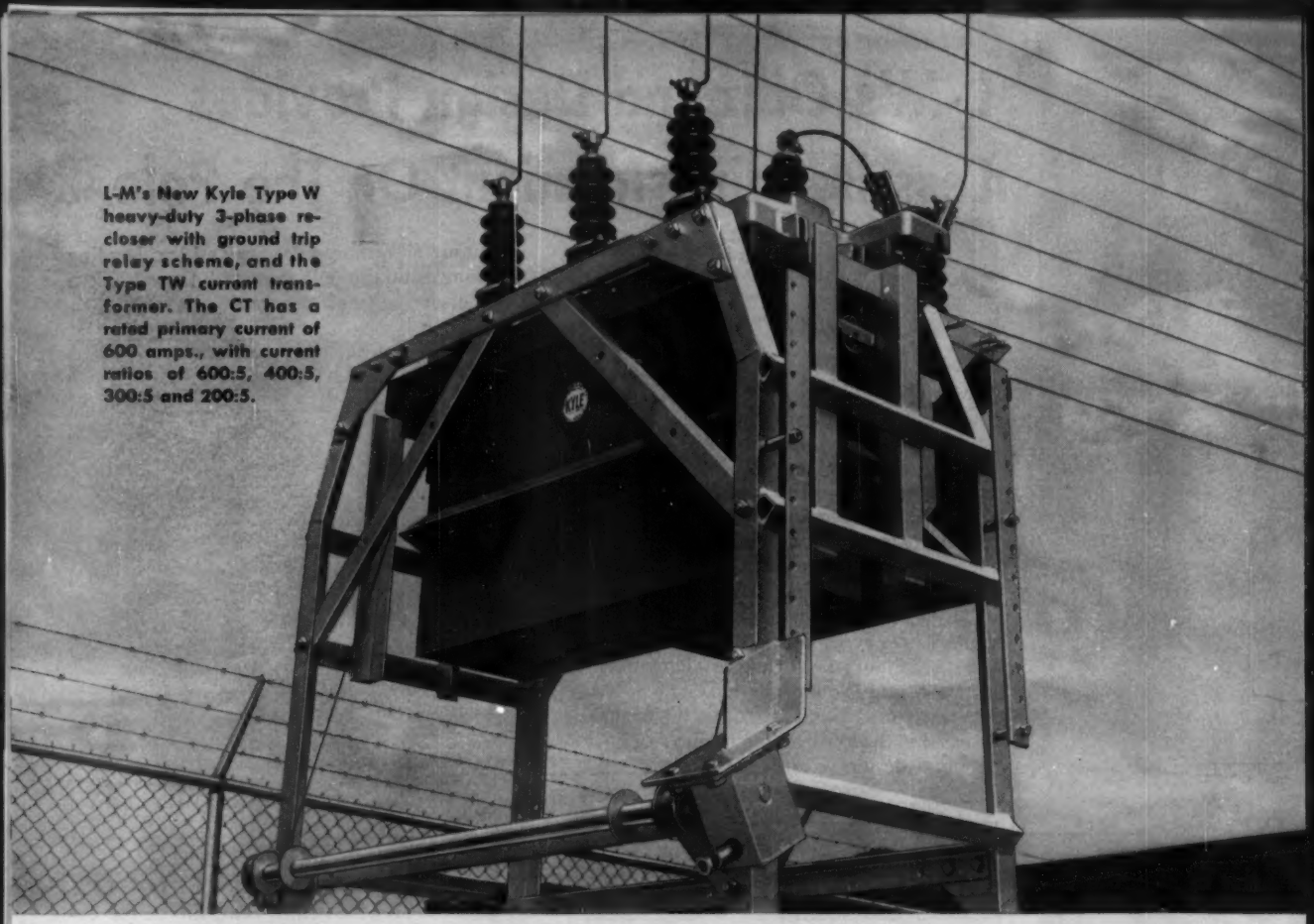
Get Details on L-M's Obround Transformer

Ask the L-M Field Engineer for application information, weights and dimensions on obround transformers and L-M's exclusive Round-Wound design. Or write Line Material Industries, Transformer Division, Zanesville, Ohio.



LM® LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Transformers

McGRAW EDISON



L-M's New Kyle Type W heavy-duty 3-phase recloser with ground trip relay scheme, and the Type TW current transformer. The CT has a rated primary current of 600 amps., with current ratios of 600:5, 400:5, 300:5 and 200:5.

At Half the Cost of OCB's...

Substation Type W Recloser Gives Greater Protection With Fast 2½-Cycle Clearing

By **FRANK McSTAY**, Product Manager, Kyle Products, Line Material Industries

Now, with L-M's new high-speed Type W Recloser, conductor burn-down of distribution feeder circuits is reduced to a minimum. This completely automatic and self-contained 3-phase unit clears so rapidly that up to 90% of the faults on typical distribution systems are prevented from becoming permanent. In fact, the Kyle Type W clears in less than half the time of distribution oil circuit breakers. This instantaneous opening results in better fuse coordination and helps to confine permanent faults to a small area.

The Type W also offers another advantage: by reducing the length of time during which fault current flows, the recloser permits using larger transformers without increasing the size of the wire on the system, or necessitating reactors to limit the available fault current.

200 MVA for Half the Cost

Besides safeguarding the distribution circuit, the 3-phase Type W offers large savings in both initial investment and maintenance. The unit is approximately half the price of an equivalent OCB for the same application.

Series over-current tripping is utilized with a selection of five time-current characteristics—fast, retarded, or extra retarded—in two degrees of slope—with 2, 3, or 4 operations to lockout, in many combinations of operations. In addition, L-M has a complete line of auxiliary equipment to provide almost any supplementary relaying scheme.

Ratings from 100 to 560 Amps.

L-M's Type W is available in normal load ratings from 100 to 560 amperes, with symmetrical RMS interrupting ratings up to 12,000 amperes at 4.8 kv and below, 10,000 amperes at 8.32 kv and below, and 8,000 amperes up to 14.4 kv. Current ratings can be changed in the field by simply replacing the series trip coils.

Get Complete Information

Ask the L-M Field Engineer for Bulletin CRIW giving more information on how L-M's new Type W recloser can be profitably applied to your system. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

LINE MATERIAL Industries Kyle® Reclosers

McGRAW-EDISON COMPANY

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EDITORIALS

We Need an All Electric Committee

Today the utility companies can wait no longer to gear themselves for the promotion and load building problems of the future. The efforts of the past, directed toward selective selling, have their place in the future. But in the fields of water heating, space heating, and electric cooking, we do not have adequate industry organizational sponsorship. The cause for this failure is obvious. But to dwell upon the cause of failure is of little importance to anyone today. It is the means whereby the industry should go forward that deserves our immediate attention.

The promotion of "all electric" living can be complete only through those whose business is all electric. There is a growing feeling that support can be secured directly from all electric companies separate and distinct from existing attachments.

A program for carrying out this type of promotional effort may be possible within the framework of the Edison Electric Institute and may thereby gather some support from combination companies interested in electric space heating, etc. But whether organized within or outside EEI, the need for an all electric promotional group is urgent. It deserves the serious support of the entire industry.

Depreciation to Actually Replace Property

"We must continue to allow the same rate of depreciation on the present property value as was allowable upon the original investment. This will permit amortization on the fair present value over its remaining life".

With these words, the Iowa Supreme Court gave their approval of the use of fair value as a basis for determining annual depreciation expense of the Iowa-Illinois Gas and Electric Company. This decision only affects the rate making for Fort Dodge, Iowa. But its application will cover the state as a whole.

This solution to the problem of economic depreciation is sound. Its application will provide relief by a proper accounting method. This seems to be superior to suggestions which call for special tax credits without corresponding depreciation allowances.

Medallion Home: What It Means To You

The centerpiece of Live Better . . . Electrically's promotion plans for 1958 is the Medallion Home Program (EW, Oct. 14, 1957, p. 79). Although the program is described in terms of five basic goals, its principal objective is to increase the "electrical content" going into new homes by establishing minimum standards for appliances installed, lighting, and wiring. Certification for meeting these standards is the bronze medallion (see cover) the local utility will award to the builders. It will be a sign to the buyer that his new home has met certain electrification requirements.

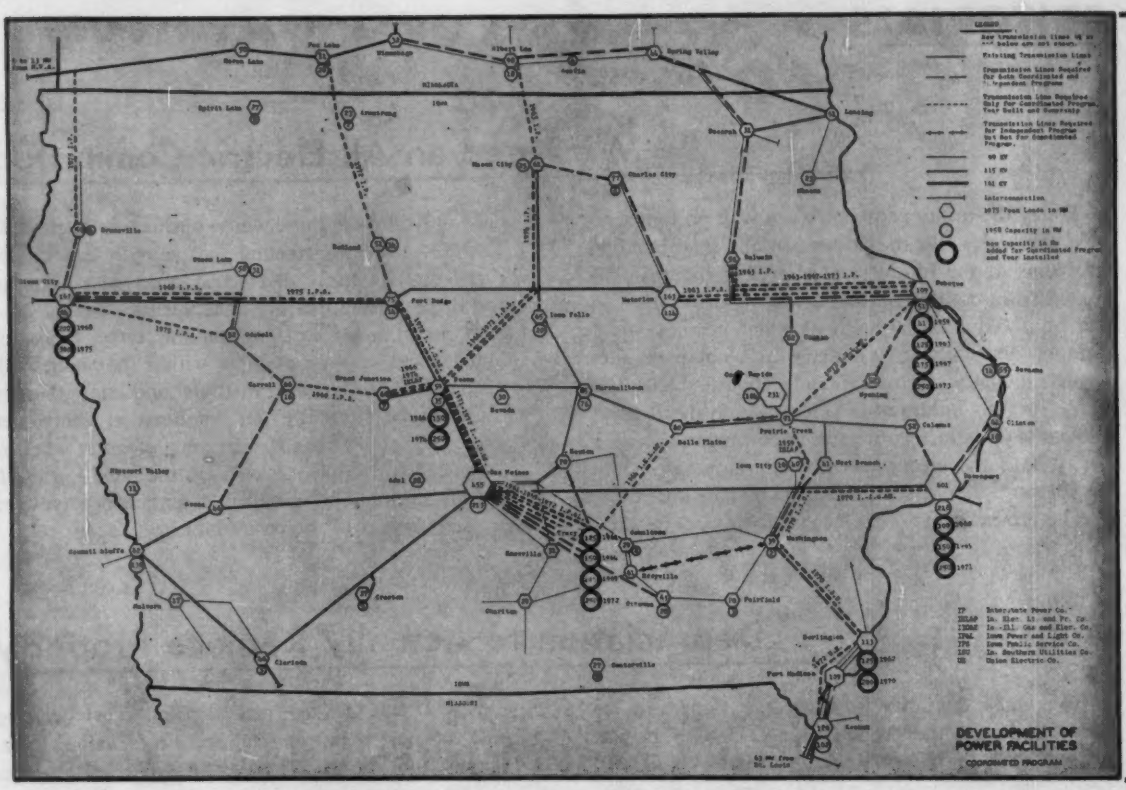
These standards have been established by Live Better . . . Electrically headquarters and the Residential Promotion Committee of Edison Electric Institute. They are necessarily flexible, and are designed as a framework within which utilities may set up their own standards, tailored to local conditions and requirements.

The importance of a new home residential electrification program stands out against the background of sagging residential load growth curves across the country. Much of this slowing down in load growth, utilities tell us, is due to the drop in new home starts. Medallion Home's importance to electric power companies is, therefore, manifest.

Electrical World realizes that the electric utility industry is constantly being called on to support a variety of different programs, all of which take time, money, thought, and effort. But in view of the overriding need to bolster residential load curve growth, and the possibilities that Medallion Home holds in that direction, we feel justified in urging the industry to get behind it. Indeed, we'd be remiss if we did not back this program in every way possible.

Medallion Home promotion has been well timed and launched. It becomes an integral part of what is very likely the most successful residential promotion program this industry has ever had. It needs only one ingredient to make it a success: your support.

We are sure that will be forthcoming.



Iowa companies map future growth in . . .

'Survival' Plan to Save $140 Million

Coordinated expansion can cut costs 10½% in 16-year period. Instead of 42 small units, they'll install 17 larger ones

Seven electric companies in and around Iowa are exploring a coordinated expansion program that could save more than $140 million between 1960-75.

The joint effort would find all generation and transmission facilities designed and operated as a single system. Some 3,091 Mw of new generating capacity would be installed during the period on the basis of capacity deficiencies, transmission, fuel costs, and water supply rather than individual company needs. This 3,091 Mw estimate does not include replacement of obsolete units.

As the plan now stands, a company would pay for new units or plants in its area. Then a portion of the unit would be, in effect, rented to a purchaser. The amount of purchased power would decrease as the owner-company's system demand grew.

Two factors pave the way for coordinated growth:

- In a recent Ft. Dodge rate case, an Iowa Supreme Court decision gave assurance of rate treatment that will help individual companies raise debt and equity capital for the program.
- Large interchanges of power are possible over an Iowa grid that is now reaching maturity.

The Iowa participants, faced with what they call an inadequate net revenue situation, view the joint effort as a cost-cutting move that will keep them strong enough for future growth. To implement the program rate increases will be needed by the participants, according to Charles H. Whitmore, president of Iowa-Illinois Gas & Electric Co. He described the plan at a recent Iowa Utilities Association meeting in Des Moines.

The over-all plan is founded on 18 months of study by the companies and a Sargent & Lundy report. Since April, 1957, two representatives of each utility have met about once a month to draft preliminary proposals. This Technical Planning Committee has ruled out atomic power as too remote for Iowa at present.

Bigger, More-Efficient Units Can Be Used

By the end of 1958, according to estimates, the Iowa companies will serve a 1,465-Mw load. By 1975, demand will hit 4,288 Mw. With the coordinated approach, the companies would install about 17 units with average capacity of 178.8 Mw during 1960-75. This size unit takes full advantage of improved efficiency of the reheat cycle. Uncoordinated growth probably would see the addition of 42 less-efficient units with an average capacity of 73.6 Mw.

Whitmore foresees these three major problems:

Many New Lines Needed

You can see from this map exactly how the expansion of seven midwestern utilities could be integrated. However, Charles Whitmore points out that this map represents only one possible plan.

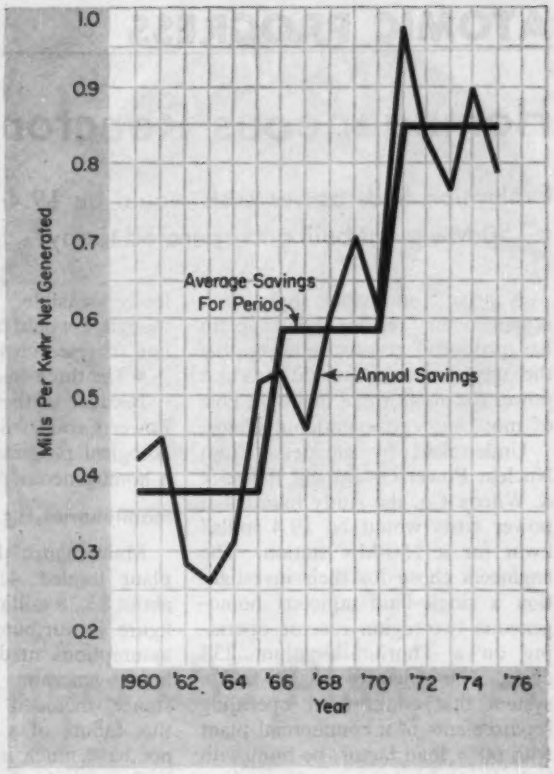
Perhaps the most striking observation is the planned capacity for the next few years. By 1965, the map shows that 816 Mw are to be installed for the coordinated plan; and by 1975, another 1,975 Mw are to be in service. Demand for the Iowa companies is expected to reach 4,288 Mw after 17 more years.

The map shows only one 161-kv and one 115-kv transmission line that would be required for an independent program which would not be required for the coordinated program.

But many transmission lines—principally in the 161-kv and 115-kv classes—will be required for the coordinated plan which would not be needed under independent programs.

Some of these transmission lines appear to be necessitated by further development of generating sites—Dubuque, for instance, should have a peak load of about 109 Mw by 1975, but will be the site of a 642-Mw bank of generators. On the other hand, Davenport's anticipated 1975 high of 601 Mw will be met by a local capacity of 718 Mw. Davenport will have fewer transmission ties. Heaviest generating center will be at Tracy (lower middle) with installed capacity of 725 Mw and strong ties to Des Moines.

The map shows ties with neighboring companies, but the 5 to 13-Mw from Missouri Valley Authority (upper left) will come instead from Missouri River Hydro.



- Developing methods of determining fair cost allocations. A more complete transmission network is needed, for instance, to permit full participation.
- Distributing savings equitably. Fuel costs or demand will produce greater savings for some companies. Savings from the joint effort for them must come from a sharing by the companies of the over-all savings.
- Establishing a "give-and-take" spirit. Each management would forsake a little of its "rugged individualism" to adapt to particular operating, financing, and policy situations.

Fuel Savings Can Touch $25 Million

Fuel savings would be one of the plan's main advantages. Fuel savings would increase from $4,462,000 in the first six years to $12,526,000 during the next five years. From 1971 through 1975, fuel costs would be cut $25,625,000. The savings would represent 8/100 mills/kwhr, 19/100, and 27/100, respectively.

With 25 fewer generating units, manpower and maintenance savings would approach $23,495,000. This is 27% less than comparable individual costs.

An investment of $506,235,000 would be required to provide coordinated generating and transmission facilities. Under separate development, the companies would have to raise more than $60 million above this amount. Fixed cost savings of $74,337,000 are possible in the 16-year program for a 13½% reduction.

The companies exploring the program are Interstate Power, Iowa Electric Light & Power, Iowa-Illinois Gas & Electric, Iowa Power & Light, Iowa Public Service, Iowa Southern Utilities, and Union Electric Co.

The program is similar to the "one system" coordinated capacity planning of Connecticut Light & Power Co, Connecticut Power Co, Hartford Electric Light Co, and United Illuminating Co. These four utilities reach contractual agreements on new capacity additions on the basis of anticipated load growth and equalization of reserve. Transmission agreements are on a joint use basis.

Plan for Survival Or Face Oblivion

Charles H. Whitmore, President, Iowa-Illinois Gas & Electric Co

The investor-owned electric industry of Iowa exists in plain view of oblivion. Across our western border in Nebraska there is no such business. It can happen here. The investor-owned electric business of Iowa will survive—if it does in fact survive—only because it deserves to survive, and only because the public is convinced of that fact.

We know that net revenues after expenses and taxes are today inadequate to support the growth which faces us. We can meet the financial need for growth in two ways: First, we may increase gross revenues; second, we can reduce our expenses.

The coordinated program requires huge expenditures of capital. It cannot become effective in economies until approximately 1961. Consequently our immediate needs must be rate increases to provide for the expenditures which will ultimately result in great economies for the customers of the Iowa companies.

Homogeneous Reactor Study Is Pessimistic

Evaluation finds power costs would be 19.4 mills/kwhr for a 150-Mw plant built and operated today

A private industrial study of a homogeneous reactor power plant has produced results showing that the type evaluated would produce power for about three times the cost of most U. S. conventional plants.

Undertaken by engineers from Nuclear Power Group and Babcock & Wilcox Co, the study found that power costs would be 19.4 mills/kwhr for a 150-Mw station. The engineers chose for their investigation a single-fluid aqueous homogeneous two-region reactor operating on a Thorium-Uranium 233 cycle. The objective was to find a system that could meet operating requirements of a commercial plant with 60% load factor, be built with today's technology, and produce power at the lowest possible cost.

The study group's report develops two main points:

- From an engineering standpoint, the homogeneous reactor plant looks feasible. To be certain, though, it would take about $10 million of research and development.
- The three-to-one cost ratio.

Because of these factors, Nuclear Power Group will wait future technological progress before exploring a homogeneous reactor plant.

Maintenance Hit 4.1 Mills

Maintenance for the evaluated plant totaled 4.1 mills/kwhr, or about $3.28 million a year. The high figure is attributed to conservative assumptions made in the analysis. Steam-generating equipment, for instance, included 24 small units so that failure of a single tube would not have much impact on capacity.

Outage time for maintenance was figured at 57.5 consecutive days, or 16% a year.

In the engineers' economic analysis it might be necessary to replace reactor vessel and associated equipment after some 15 years of operation. About 22 different categories of tools and equipment were deemed necessary. They would represent an investment of almost $1.63 million. A spare parts inventory would be worth about $2.7 million.

Fixed charges for reactor and turbo-generator plant facilities were estimated at 13.9% of the invested capital, based on a depreciation life of 30 years. Non-depreciating land investment was calculated at 12.6%. Total plant investment was $56,358,100. This would mean a unit investment cost of $376/kw.

About 40 people would be employed on the plant's operating staff, not counting maintenance labor and processing plant personnel. Cost for a staff this size was estimated at $310,000, or 0.4 mills/kwhr.

Companies participating in the Nuclear Power Group are American Gas & Electric, Central Illinois Light, Commonwealth Edison, Illinois Power, Kansas City Power & Light, Pacific Gas & Electric, and Union Electric.

NUCLEAR NOTES

AEC has invited bids to design, develop, build, and test operate a boiling water reactor for the Rural Cooperative Power Association at Elk River, Minn. Cost-type contract with maximum ceiling price will also include a 22-Mw fuel-fired plant.

A company-financed A-project may be considered by Detroit Edison Co some time after 1960, Walker Cisler, Detroit Ed president, said recently before Security Analysts of San Francisco.

"Hook-on" reactor concept will be studied by General Public Utilities Corp with a view toward installing a small boiling water type at Penn Electric Co's Saxton, Pa., station, using existing steam turbo-generators. In a report to the Joint Committee on Atomic Energy, GPU also concluded that a 60-Mw nuclear plant in Manila was not now economically feasible.

Power from fusion is AEC's goal in letting contracts to Allis-Chalmers and RCA for design and construction of "experimental devices" for a Princeton, N. J. stellerator.

Natural uranium, gas-cooled graphite-moderated, power reactor will be designed by Kaiser Engineers, Oakland, Calif., under contract from AEC. ACF Industries, New York, will be a subcontractor on the 40-Mw project.

No critical engineer shortage appears to exist in the field of privately-supported atomic energy work, according to the Atomic Industrial Forum.

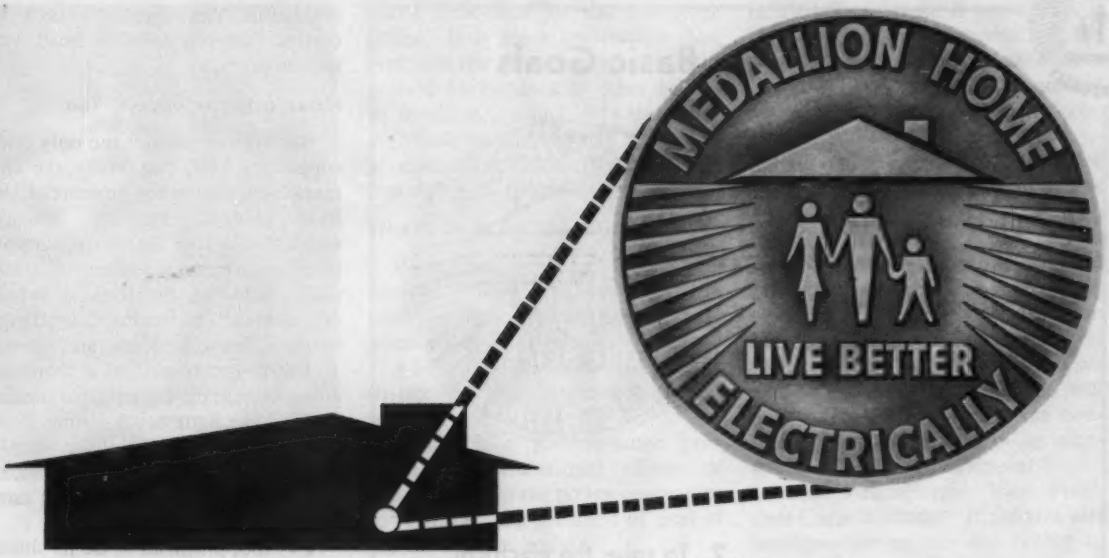
Public Reaction . . .

. . . is critical after Britain's radiation incident; scientist dissension reported

McGraw-Hill World News—Few additional details have been released by Britain's Atomic Energy Authority on the cause of an overheated reactor earlier this month (EW, Oct. 21, p 40). The incident took place at a Windscale plutonium factory near the Calder Hall nuclear power station Oct. 10.

Some revealing public reactions to radiation hazard have come to light, however. It was clear from the start that AEA minimized the potential hazard. What is being seriously questioned and criticized is the degree of understatement used. Only fortuitous circumstances—not firm

(*Continued on page* 52)



'Medallion Home' Spurs LBE Plans

• Live Better Electrically's new-home promotion is aimed at boosting sales of homes along with their 'electrical contents'

• Bronze medallion will be permanent symbol-certification that home meets standards for appliances, lighting, wiring

The "Medallion Home" program, Live Better Electrically's all-industry bid to boost both the sale and construction of new homes and their "electrical contents," was launched recently in New York (EW, Oct. 14, 1957, p 79).

According to LBE headquarters, "The new home program, planned to serve as a national framework for locally sponsored activities, is the first nationwide program ever to be sponsored by the electrical industry specifically to give prospective home buyers a recognizable hallmark attesting to a new home's electrical livability."

Standards Set for Homes

Basic idea behind Medallion Home is to set standards for the electrical content of new homes. When homes meet these standards, the local utility will award the 3-in. bronze medallion to the builder. He will place this somewhere outside the home, where it will be "visible but not conspicuous."

As is the case with its parent program, Live Better Electrically, Medallion Home is planned to be spearheaded by some 300 utilities. It is they who will establish the standards for homes in their areas, within the national framework. These standards will cover:

- Appliances installed
- Wiring
- Lighting

Standards Flexible

Necessarily, these will have to be flexible so that they can be adapted by the utility to local preferences and needs. Said R. E. Ingmire, manager of Inter-Industry activities for LBE, "The utility companies exclusively will be empowered to award medallions to qualifying home builders in their service areas."

The standards, as prescribed by Live Better Electrically, are as follows:

Appliances—At least three major appliances are required in addition to an electric range.

Wiring—Wiring must conform to local utility requirements. In the absence of such requirements, 100-amp service entrance is recommended.

Lighting—Lighting must be in conformance with recommendations established by the utility. Again, in the absence of such requirements, lighting shall comply with those standards established by the American Home Lighting Institute.

Five Specific Goals

Medallion Home has five specific goals. These, as set down by LBE headquarters, are:

(1) To give the prospective home buyer a recognized symbol of electrical excellence in his new home.

(2) To raise the electrical contents of these new homes above what they might otherwise be.

(3) To give the home builder an assist in selling his homes by educating his customers to the advantages of electrical living.

(4) To show the millions of visitors who go through these homes—even when they are not prospective buyers—the electrical living features that they need to be comfortable in their own homes.

(5) To give national support to existing electric homes programs that utilities put together to boost

Program's 5 Basic Goals

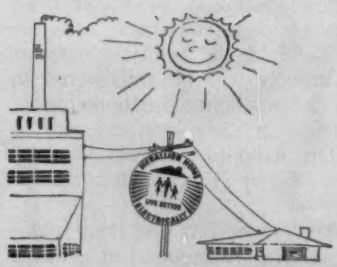
1. To provide prospective home buyers with a recognized symbol of electrical excellence in new homes.

2. To raise the electrical content of new home construction beyond the present minimums.

3. To help builders sell homes by educating their customers to the benefits of electrical living.

4. To show visitors to new homes the electrical living features that are needed in their present homes.

5. To give national support to existing programs sponsored by utilities to upgrade home electrification.



residential electrification (such as certification programs of local wiring bureaus).

Manufacturer Support, Too

But utilities are not the only ones supporting MH. Nationally, the 180 manufacturers who support LBE have pledged support. Locally, under the aegis of the utility, support is coming from a variety of trade allies including distributors, retailers, contractors, realtors, mortgage bankers, home builders, and others.

The program will get a thorough going-over in the big national media, such as the Saturday Evening Post. Shelter magazines, such as Better Homes and Gardens and American Home will carry advertising and editorial support.

TV, too, promises to do its share. Some 40 million viewers will get the Medallion Home message via commercials on "General Electric Theater" and programs sponsored by other manufacturers, such as Westinghouse and Whirlpool.

Timing is Important

Timing of the program is important. LBE launched Medallion Homes in the fall in order to give utilities time to develop local momentum by spring, traditionally the boom time of the home building industry. Accordingly, the first Medallion Homes will go on display in April of 1958. The program is planned to continue indefinitely. By the end of next year, Live Better Electrically estimates some 100,000 homes will be identified with the medallion yearly.

For homes that stand way above the minimum, i.e., for all-electric homes, there will be a special gold medallion. This permits the utility to recognize the all-electric quality of such homes without tying its Medallion Home standards to it, and therefore diminishing their flexibility. The annual target figure set by LBE for Gold Medallion homes is 20,000.

Why 'Medallion Home'?

Why a Medallion Home program in the first place?

Utilitymen, manufacturers, and others needn't look far for the answer to that one. A big one probably lies in the drop in new home starts in the 1956-57 period.

According to U. S. Department

LBE'S BOIAN: ". . . tight competition and intensive drive"

of Labor statistics and Construction Daily, a McGraw-Hill magazine, new non-farm dwelling units started in 1956 totaled 1,118,100, down almost 16% from 1955's 1,328,900. For the first eight months of 1957, the figure stood at 700,500 new home starts, compared to 789,600 for the same time in '56 and 942,-800 in 1955. This August 1957 figure was the lowest for the period since 1949.

Effect on Residential Load

This already has been reflected in the sagging residential load growth curve. Still moving up, it is nevertheless doing so at a markedly slower rate than in the last few years. Power company officials view this with deserved consternation.

Manufacturers, too, have cause for concern. Any drop in new home starts is bound to have its effect on appliance and equipment sales, and in turn, on generating and T&D equipment.

No one pretends that the soft building market is the sole cause of the drop in load growth and appliance sales, but it is an important one, and something had to be done about it. Hence, Medallion Homes.

Increasing competition is another reason. In describing Live Better Electrically's plans for '58, of which Medallion Home is the governing element, Robert E. Boian, LBE boss, said, "This drive in 1958—the most extensive to date—is dictated by the increasing competition among major industries for the consumer dollar. It is more imperative than ever that the electrical industry gain ground by banding together to sell its common product—electrical living. Only in this way can individual segments of the industry secure their just shares of the consumer dollar."

What's In It For the Utility?

What, then, is in Medallion Home for the utility? The answers seem obvious. Among other things, prospects seem good for:

- Providing an immediate crutch to stop the drop in residential load growth.
- Launching a long-range program, the educational effects of which will help the power companies toward the long dreamed of goal of the all-electric home.
- Giving a much needed shot in the arm to local businesses in general, and especially to building trades, financing agencies, and appliance dealers, resulting in
- An intangible, but not discountable public relations gain.

Trade Allies Indorse

Apparently, leaders in allied fields see the advantages. George Goodyear, President of the National Association of Home Builders, has given it a warm endorsement. R. E. Ingmire, in his announcement of the program, quoted both P. L. Prentice, editor and publisher of House and Home, and Fischer Black, editor and publisher of Electrical World, as being strongly in favor of it.

So far as the manufacturers' stake in Medallion Home is concerned, it was attested to by several of the panel of seven leading executives in the name appliance field present at the Live Better Electrically conference.

Said John Hurley of Whirlpool Corp, while outlining his company's 1958 LBE plans: "We have long realized that home owners cannot enjoy the full benefits of electrical living if their homes are inadequately equipped. Therefore the Medallion Home program will be a significant factor in our future plans. We shall support this new program and will employ it to help upgrade the contents of new homes from an electrical equipment standpoint."

And Westinghouse Vice President Chris Whitting: "Right now our headquarters people are taking to the road for a nationwide series of meetings with the regional Westinghouse people who work with the building industry. In these meetings we will show how our resources can be thrown behind the Medallion Home which Live Better Electrically has developed."

Or Walter Jeffrey of Kelvinator . . . "The Medallion Home is a welcomed new dimension to the basic market development campaign. May I say that (it) provides us with a really effective tool in selling builders more electrical equipment in new homes."

Filling a wide gap in the industry's market development front, and off with a good launching, LBE's Medallion Home program looks as though it's here to stay.

"I know of no other national program in recent years that has offered home builders a greater opportunity to gain both prestige and profit by building and selling the kind of homes all America is looking for"

GEORGE GOODYEAR, President, National Association of Home Builders

MANUFACTURERS' PANEL of executives attended LBE conference to outline their companies' 1958 plans. Man at center (name down) is Hotpoint President J. C. Sharp; at distant right is Whirlpool Vice President John Hurley

LBE Makes Other Plans for '58

'Home Medallion' program is centerpiece of 1958 promotional plans, but other activities go on as well. Pitches and pushes tied to EEI promotion calendar for better coordination

Important as the Medallion Home program is to Live Better Electrically's 1958 plans, it is not the whole story. R. E. Boian, in outlining the '58 plans in general terms, described them adding up to a "12-months a year" operation, highlighted by peak pushes in spring and fall.

Boian's remarks were detailed subsequently by Detroit Edison Co's E. J. Hurley, chairman of Edison Electric Institute's Residential Promotion Committee. "Themes and timing for 1958 promotions are compiled in calendar form to facilitate industry-wide coordination of activities," Hurley said.

HURLEY: rally . . round the calendar

"The purpose of this EEI calendar is to set up a schedule for promotion of major and portable appliances, lighting and other services during specific periods of the year. In this way, it will help rally electric utilities, manufacturers, distributors and dealers to plan advertising and sales campaigns on a coordinated basis."

Here's the line-up:

- Laundries—Spring and fall
- National Electrical Week—Feb. 9-15
- Ranges—Spring and fall
- Water Heaters—March, April and May
- Dishwashers—Year 'round
- Housewares—Spring and fall
- Food freezers, refrigerators, air conditioners, dehumidifiers — May June, July and August.
- Model homes and Housepower —February, March, April and September, October and November.

Promotion Kits Available

Special LBE local advertising kits will also be made up for the calendar campaigns. These will contain suggested ad copy and layouts, TV and radio commercial aids, and other sales tools.

But the biggest highlight of the Live Better Electrically '58 kick-off was the whopping manufacturer executive-power represented by a panel of seven prominent manufacturers, who came to give LBE their blessings and benedictions.

Philco's J. M. Otter claimed LBE's greatest contribution lay in helping the appliance industry establish a national advertising schedule. Otter's example: Philco's range ad run Oct. 18, during the range promotion period, is headed, "Key Your Kitchen to Modern Living—With an Electric Range."

Walter Jeffrey of **Kelvinator** said flatly K's plans call for increased emphasis on the LBE theme in national advertising and promotion.

G. H. Menge, of General Motor's **Frigidaire** Division: "We plan to display the Live Better Electrically theme in our national magazine advertising as well as mention it on the 'Patrice Munsel Show' Frigidaire will sponsor on television."

Hotpoint President John C. Sharp had this to say: ". . . my faith in the future of the electrical industry is enhanced by the wonderful progress Live Better Electrically has made in just 18 months. Hotpoint, for one, will help see that this progress continues in 1958."

General Electric Co's new executive vice president, James H. Goss, opened his remarks with "General Electric will promote Live Better Electrically heavily in 1958 throughout our consumer product divisions . . ."

And **Westinghouse's** Chris Whitting adds, ". . . we will put the Live Better Electrically symbol in every ad we run in 1958 . . ."

Lastly, John Hurley of **Whirlpool** said, "Whirlpool Corp definitely plans to back up its belief in Live Better Electrically with extensive support in its national magazine and television advertising."

SAFETY AWARDS taken for Luzerne E&G by A. Davis; Duquesne Light, T. S. Egg; Metropolitan Edison, G. R. Parry; South Penn Power, W. T. White. R. P. Liversidge, PEA president, A. C. MacBurney, PEA Safety Committee presents

PEA Told Industry Must Sell Self

Philadelphia meeting hears confidence of public and of government commissions is essential in this nuclear age

Selling the industry——the objectives and benefits of private power ——is the biggest and most important job ahead. This became the central theme of the 50th annual meeting of the Pennsylvania Electric Association, Oct. 2-3, at Philadelphia. In the keynote speech, R. G. Rincliffe, president, Philadelphia Electric Co, said:

"The future presents even greater challenges which will not be technological, but rather how to widen an understanding and appreciation of a free economy. It will be a matter of continuous education to convince customers and employees that we are ever mindful of their interests, that we are supplying reliable service at the lowest cost, and that through independent ownership the interests of customers and owners are best served."

Tax Uniformity Urged

George M. Gadsby, board chairman, Utah Power & Light Co, reported that "the industry has failed to make clear to the public the real source of taxes paid by electric companies and their function as collection agencies." It should be crystal clear that equivalent taxes should be paid by users of government power because the electric supplier is not the taxpayer, but only the tax collector.

"If the confusion the public power people persist in introducing into the tax situation can be brushed aside and the position of the citizen as a taxpayer made clear, no fair-minded citizen will object to uniformity, just as they expect uniformity in the assessment of merchandise excise taxes," Gadsby said.

Cites Kerr Bill

Another false premise, said Gadsby, supports the preference clause: The "people" put up the money for federal projects; therefore, the "people" should have first call on the "cheap-by-subsidy" power. While all taxpayers equal the "people" on the paying side, only local beneficiaries equal the "people" on the receiving side. When taxpayers generally realize the unfairness of this foreshortened equation, insistent demand will be made that the "people" must be the same in both instances.

Gadsby declared that the TVA revenue bond bill introduced by Sen Kerr (D-Okla.) revokes the assurance in all earlier TVA appropriation bills; that money appropriated for supplying electric service in the TVA area would be returned with interest. The 1958 AEC appropriation act, he said, directs the commission, against its expert judgment, to build nuclear reactors for three nonprivate agencies. Federal taxpayers are to put up the money, take all the risks, pay all operating and maintenance costs. Yet, these public power agencies will be charged only the calculated cost of the steam on the basis of conventional fossil-fuel generation.

The electric utility industry must win the aid and encouragement of regulatory bodies and receive credit for their investment in nuclear power development, said J. Carlton Ward Jr., president, Vitro Corp of America. If the industry fails to influence the regulatory bodies, said Ward, the government will step in and do the job. He added that involvement of nuclear power in politics is an essential aspect of democratic government.

Asks Research Support

In this nuclear age utilities must take the lead by supporting basic research programs at universities, Ward continued. A program for research and development must be presented to regulatory bodies as

the accepted pattern, so that development expenses will be considered as a part of the cost of electric service.

More effort must be expended and greater risks accepted by the industry to bring about economic nuclear power, said Joseph Sharfsin, Commissioner, Pennsylvania Public Utility Commission. In undertaking development of nuclear power, the early stages are uneconomical.

It will become imperative to provide statutory direction and regulation of nuclear power soon, Sharfsin said. This regulation must correlate the various departments and bureaus of state government concerned with nuclear power. As responsibility shifts from the federal level, state and local authorities will have to provide public protection.

Forecasts for 1970 show a population of 200 million, a potential labor force of 84 million, and a gross national product of $600 billion (1953 dollars), said Charles E. Oakes, president, Pennsylvania Power & Light Co. If the nation is to reach a $600-billion economy, business and industry will need more than 830 billion kwhr. Coupled with expanded needs of 57 million residential and rural consumers in 1970, 1 trillion 400 billion kwhr will be needed. This means a total capacity of 310 million kw in private and government sources, nearly 200 million kw more than last year. Investor-owned capacity will be around 250 million kw.

Gives Construction Needs

Electric companies face estimated new construction of $70 billion by 1970, said Oakes. Of this, $25 billion would be available from depreciation and retained earnings and $45 billion from new money. Oakes stated it seems reasonable that the industry will be able to generate $25 billion internally, while maintaining present capitalization ratios and increasing the common dividend payout at around 80%.

Earnings must be kept at levels attractive to the equity investment market, said Oakes.

"It is imperative that we find new ways to stimulate sales," said Philip A. Fleger, board chairman, Duquesne Light Co. He noted that although runway inflation may be prevented, a continuing rise in general price level appears to be an integral part of the basic economy. The rate of increase in residential consumption has been leveling off for the past three years, and electric appliances' portion of spendable income for durable goods has been declining since 1950. Hence, actual sales will not meet levels forecast for the next few years.

Public Reaction

(*Continued from page* 46)

know-how—now seem to have reduced the scale of the incident.

Ten days after the accident, growing disquiet finally gave way to a full-blooded public outcry from all levels about health and property.

Meetings were called by Calder Hall workers to decide whether they would continue working in spite of AEA assurances. They stayed. Miners in the area received additional assurance that the workings were not contaminated. Farmers complained that property and livestock values were dropping.

Evidence of dissension amongst scientists working at Windscale and Calder Hall has been reported. They maintain the AEA plan of evacuating all of South Cumberland should have been carried out. Some medical experts concur. The charge is that AEA did not have sufficient grounds on which to suppose that strontium 90 was being effectively filtered out of materials that spewed forth from the factory's chimney.

Other scientists outside the AEA have indicated that this is not the first time radioactive fallout had occurred at Windscale. This was just the first time it got out of hand. One source suggested there even may be a link between an increased death rate from leukemia in the area. The rate was two deaths in 1950 when the plant opened. The rate last year was 14—the annual average rate for the country.

Reactor Accident...

. . . can't happen in U. S., say AEC officials in wake of Britain's damaging incident

Atomic Energy Commission officials are convinced that an accident similar to Britain's disaster at Windscale could not happen here.

There are several reasons for this opinion:

- The U. S. has no plutonium producing reactor similar to the English open-circuit, air-cooled unit where the incident took place (EW, Oct. 21, p. 40). All U.S. production reactors are cooled by water under great pressure. Thus there is no possibility of discharge of contaminated gases from the reactors.
- The U. S. has built its production reactors on the assumption that any radioactive contamination arising from an accident will be confined to the site. Thus the Savannah River installation is in the middle of an uninhabited 300-sq mi area. Hanford, in Washington, is in an 800-sq mi isolated area.
- At Hanford, AEC has asked the Interior Department to prohibit any irrigation and settlement of certain lands across the Columbia River because there is a possibility, even though remote, of wind-borne contamination settling there. This possibility comes from the plant where radioactive waste products are separated out from the unburned fuel. There is a stack discharge which, if other safety devices and procedures failed, could discharge radioactive particles into the air.

In general, all AEC reactor installations have elaborate safety instrumentation and well-prepared disaster schemes.

Within the plants, monitoring devices are set up to give alarms the moment radioactivity rises beyond prescribed levels.

In the only U. S. reactor comparable to Windscale, that at Brookhaven Laboratory, there are monitoring devices in the stack itself so that operators know at all times how much radioactivity, if any, is passing out into the air. While this reactor is air-cooled, it differs from the English one in that it is purely for research and thus operates at much lower power levels.

Atom Review Urged

Stronger leadership by the Atomic Energy Commission and review of the U. S. atomic program was recommended in New York last week.

Conferees at the Twelfth American Assembly said the review "should lead to a clear formulation of the program's objectives in terms of the national power needs of the U. S. in the long run as well as the immediate requirements of the U. S. foreign policy."

The more than 60 business men, scholars, and scientists attending the session issued a summary report. In it they agreed that private industry can't develop an atomic power program without federal aid. They urged a truce between public and private power interests to facilitate economic development of the atom.

The AEC was asked to "strengthen its internal administration of the program with primary emphasis on positive accomplishments of its objectives in the power field."

Truck Lift Proposed

Cleveland Electric Illuminating Co is considering a third assault on the high costs of coal deliveries. A flow truck delivery has been proposed as "another way of cutting our transportation costs," a CEI official said. The utility has a 108-mi coal pipeline to one plant and also is starting construction of a big mine-mouth station. Trucks will be tried six months.

Dual Role Misgivings

The conflict of interest charge in the Dixon-Yates contract with Atomic Energy Commission was pressed by the government last week. Attorney Saul R. Gamer sought to show the contract was invalid because Adolphe H. Wenzell was advising the Budget Bureau at time of contract negotiations while still employed by First Boston Corp, an investment banking firm.

Wenzell told Gamer he had misgivings about his dual role. He said that two days before Mississippi Valley Generating Co made its first contract proposal he told Rowland Hughes, then Budget deputy director, of his misgivings. First Boston might later be asked to market the MVGC bonds, Wenzell told Hughes.

First Boston lawyers said Wenzell had been advised to end his Budget connection. Subsequently First Boston was appointed financial agent for the power company but took no fee.

MVGC claims its contract with AEC is valid and there was no conflict of interest because Wenzell was asked to get firm figures on financing costs and, as such, he was serving a common and not conflicting interest.

The testimony came in Washington where MVGC's contract claims case has been resumed after opening in New York Sept. 25. The company seeks $1.9 million for money it says was lost on starting a West Memphis, Ark., power plant. Power from the plant would have fed into Tennessee Valley Authority's system.

TVA, BPA Revenues Climb

Fiscal year financial statements for Tennessee Valley Authority and Bonneville Power Administration show revenue gains over 1956.

TVA's net revenue of $58.1 million on sales of electricity represents a return of 4% on the average investment in power facilities of $1,470 million, the authority said. Total power operating revenues were $235,733,000, or $14.1 million above fiscal '56.

Gross power revenues for BPA totaled $66,399,-970. This represents an 8.87% increase. Net revenues hit $5,965,735. Although the '57 gross is highest on record, the record net was achieved in 1952 at $15,890,641, the agency said.

Farming Revolution

New power uses may "bring a virtual electrical revolution" on the farm. This is the prediction of two Battelle Memorial Institute scientists.

In an article in the institute's current "Review", Harold J. Behm and R. Glen Fuller foresee wide use for these developments by the year 2,000:

- Mobile generators and electrically driven equipment in the field.
- Barn and poultry house air conditioning.
- Plant maturation through lighting.
- External forces to alter plant growth.
- Electromagnetic radiation to replace smudge-pot frost prevention and cultivate soil.
- Electric motors replacing piston engines to prepare and cultivate the soil.
- Nearly automated poultry plants.
- Farm management computers.

British Firm Lands Contract

British Columbia Electric Co has awarded a $25-million contract for six units of the 900-Mw thermal plant the company will build to the British firm of Metropolitan Vickers Electrical Export Co, Ltd. Agent for the British firm is Canadian Westinghouse Co.

The contract calls for manufacture and installation of turbo-alternators, condensors, and feed heat system. A firm contract has been placed for four thermal units with option on the two remaining 150 Mw units.

BC Electric also has signed a contract with Westcoast Transmission Co for 144,000,000 cfd of gas from the Peace River area to feed the new plant.

Single-Phase Nets These Unit Savings over 3-Phase

Customer's Unit	Existing Overhead System		New Overhead System		
Saturation	4%	25%	25%	50%	100%
3-hp air conditioner	$536	$245	$330	$184	$114
5-hp air conditioner	418	276	329	197	164
3-hp heat pump	387	219	322	247	164
5-hp heat pump	479	215	384	259	183

For booming residential air-conditioning and heat-pump loads . . .

Single-Phase Service Costs Less

- **Recent studies by Kansas City Power & Light Co reveal an impressive cost advantage for single over 3-phase**
- **Eight cases were compared on existing and new systems at various air-conditioning and heat-pump saturations**

E. B. McBURNEY, Engineer, Kansas City Power & Light Co, Kansas City, Mo.

Single-phase residential service for booming air-conditioning and appliance loads offers an impressive cost advantage over 3-phase. Recent studies by Kansas City Power & Light Co, made to determine how best to serve these growing loads on an existing distribution system, showed a decided saving for single-phase in all of eight comparative examples of high-usage residences.

The company could not economically justify scrapping a secondary distribution system to install a new one. Therefore single-phase 120/240-v service was compared with 3-phase 240-v delta to determine the more economical way of serving the increasing air-conditioning and heat-pump loads.

Single and 3-phase service were compared for:

- An existing overhead primary and secondary system with 1.25-kva diversified demand per customer and air-conditioning saturations ranging from 4 to 25%.
- A new overhead primary and secondary system with 1.25-kva diversified demand per customer and air-conditioning saturations of 25, 50, and 100% for new residential areas.

Because of the trend toward 3 and 5-hp central air conditioning and heat pumps, such units were selected for the study. Comparisons of single vs 3-phase were made for each of these four units applied to both existing and new systems. These eight examples were based on 3 and 5-hp motor-driven compressors.

Area Needs Analyzed

To obtain the most reliable figures for determining future loads, a careful analysis was made of different areas. In a typical suburb in Johnson County, Kan., load has increased for the past 10 years at the annual rate of 27%. Naturally, system design for such an area must be more liberal than for an established urban area with a more normal growth rate of 5 to 7% per year.

Both urban and suburban areas were considered in the comparisons. In urban areas, low saturations of air conditioning and heat pumps were assumed. In suburbs, saturations up to 100% were studied.

In comparing costs, each air conditioner or heat pump was assumed to have the same rating, load, and type of service, either all single or 3-phase. Costs in each instance were the capital investment required to install transformers, extend primaries, add secondaries, and install services and meters.

Both new and existing areas were assumed to have 36 poles. Existing areas, had four customers per pole and four 25-kva transformers with four spans of secondaries in each direction. As air-conditioning and heat-pump saturations increased, the area was designed so that transformers would have one span of secondaries in each direction and would serve 12 customers. This design was also used in new areas (Fig 1).

An early problem was establishment of the probable order in which the air-conditioning and heat-pump units would be installed (Fig 2). The area was assumed to be served by a single-phase primary lateral and a 3-phase primary at right angles to the lateral on pole 19 (Fig 1). The order for connecting units to the system was established first by determining the number of poles that would have 4, 3, 2, 1, and 0 units for 25 and 50% saturation.

Maximum Demands Vary

Distribution of units was determined by drawing slips from a hat. Four sets of slips, numbered from 1 to 36, represented the four services per pole for the 36 poles. Drawings were compared with calculated probabilities, and the distribution in Fig 2 was the result. System expansion was then carried out by making only the necessary

additions for each successive saturation.

Each load in the study presents a different maximum demand. This aspect requires consideration of each example individually to determine the demand placed on the transformer by the air conditioner or heat pump.

Published data and demands experienced by Kansas City P&L were used in developing a set of diversified demand curves (typical set shown in Fig 3). These curves were used as the basis for determining diversified loads at the transformer.

One Phase Grounded

Transformers in each example were single-phase 7,620/120/240-v units. Their sizes were determined strictly on a required capability basis.

In the 3-phase comparisons, for loads less than 25 kva, two single-phase transformers were connected for open-delta 240-v operation. For greater loads, three single-phase transformers were used in the standard delta 240-v connection with a 3-wire power service.

On both open and closed delta connections, one phase of the secondaries was grounded. A single-phase transformer used with the 3-phase bank supplied lighting and

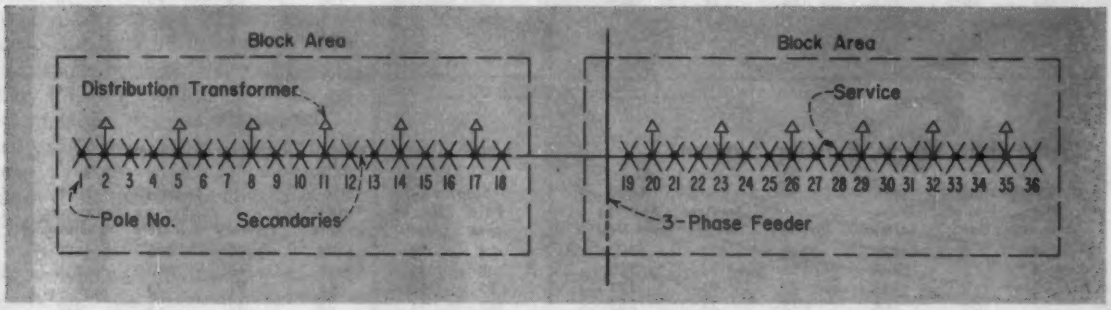

Block Area
Distribution Transformer
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Pole No.
Secondaries
Block Area
Service
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
3-Phase Feeder

FIG 1—TYPICAL SERVICE AREA for the comparative study consisted of 36 poles in two blocks. In existing areas there were four customers per pole and four 25-kva transformers with four spans of secondaries extending in each direction

Steps	Pole Number																																Saturation
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
1	•			•	•						•													•								•				
2					•									•						•									•		•				•	
3				•					•									•								•				2					
4			•		•			•					•			•								•											
5	•								•													•			•				•				•			
6		•					•						•						•		•				•											
Total	2	1	1	2	3	0	1	1	2	0	1	0	2	1	0	1	0	1	1	1	1	1	0	2	2	1	0	0	1	1	3	0	2	0	0	1	25%
7														•	•	2	•										•									
8					•	•																•	•								•	•				
9		•										•				•							•			•	•									
10						2			•						•									•		•										
11													•	•					•										•				•		•	
12				•														•		•								•						•	•	
Total	2	2	1	3	4	3	1	1	3	0	1	1	3	3	2	4	1	2	2	2	2	3	1	2	3	2	2	1	2	1	4	1	3	0	2	2	50%
13				•																				•								•			•	2	
14				•										•							•						•		•								
15										•						•		•									•		•					•			
16									•		•										•		•	•				•									
17				•			•		•								•						•												•		
18	•								•			•	•										•	•													
Total	3	2	4	3	4	4	1	3	4	1	3	2	3	4	2	4	3	2	3	4	2	4	4	4	3	3	3	3	2	2	4	2	3	2	4	4	75%
19							2								•		•											•		•						
20											•	•						•								•				•				•		
21		•																•									•		2			•				
22										•		•	•									•										•		•		
23		•		•				•							•							•					•									
24	•						•			2									•														•			
Total	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	100%

FIG 2—ESTABLISHING PROBABLE ORDER of installing air-conditioning and heat-pump units was a problem. The distribution above was arrived at by drawing slips from a hat and comparing results with the calculated probabilities

8 Examples Reveal Savings of Single over 3-Phase

3-Hp Air Conditioning, Existing System

Saturation Per cent	No. of Units	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
4	6	$185	$268	$83	$536
8	12	173	136	77	386
12	18	154	92	79	325
17	24	139	63	79	281
21	30	141	46	78	265
25	36	133	34	78	245

5-Hp Air Conditioning, Existing System

Saturation Per-cent	No. of Units	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
4	6	$97	$244	$77	$418
8	12	169	136	75	380
12	18	184	91	75	350
17	24	177	68	75	320
21	30	162	55	75	292
25	36	156	45	75	276

3-Hp Heat Pump, Existing System

Saturation Per-cent	No. of Units	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
4	6	$70	$240	$77	$387
8	12	140	115	75	330
12	18	128	87	75	290
17	24	108	72	75	255
21	30	114	46	75	235
25	36	103	41	75	219

5-Hp Heat Pump, Existing System

Saturation Per-cent	No. of Units	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
4	6	$105	$299	$75	$479
8	12	88	148	75	311
12	18	84	91	75	250
17	24	93	52	75	220
21	30	103	35	75	213
25	36	117	23	75	215

3-Hp Air Conditioning, New System

Percent Saturation	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
25	$178	$75	$77	$330
50	73	38	73	184
100	23	19	72	114

5-Hp Air Conditioning, New System

Percent Saturation	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
25	$177	$75	$77	$329
50	86	38	73	197
100	73	19	72	164

3-Hp Heat Pump, New System

Percent Saturation	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
25	$170	$75	$77	$322
50	136	38	73	247
100	73	19	72	164

5-Hp Heat Pump, New System

Percent Saturation	Trans-former	Primary	Secondary, Service, Meters	Total Savings per Unit
25	$232	$75	$77	$384
50	148	38	73	259
100	92	19	72	183

A diversified load of 1.25 kva per customer was assumed for load other than air conditioning.

For three-phase loads, cost of a single-phase transformer was included for separation of power and lighting loads.

For three-phase loads less than 25 kva, two transformers were connected open delta; for larger loads, three transformers were connected closed delta.

Air-conditioning and heat-pump loads were assumed as follows: 3-hp air conditioner—4.5 kva for single-phase, 5.0 kva for 3-phase; 5 hp air conditioner—8.1 kva for single-phase and 8.5 kva for 3-phase; 3-hp heat pump—9.5 kva for single-phase and 10.0 kva for 3-phase, including 6-kw auxiliary resistance heating; 5-hp heat pump—16.5 kw for single-phase and 17.0 kva for 3-phase, including 10 kw auxiliary resistance heating.

In each case above, savings of single over three-phase are $35 for service and $35 for meters. Therefore, savings for secondary are that amount above $70 in column labeled "Secondary, Service, Meters."

other single-phase load. This feature separated the power and lighting loads, providing separate transformers and secondaries for each.

Therefore, on all 3-phase loads the cost of a single-phase lighting transformer was added to the cost of the power bank. This addition widens the economic superiority of single over 3-phase.

Conductor Size Critical

In a comparison such as this the size of the secondary conductor is critical because of the voltage drop that may be encountered. As it has long been the policy of Kansas City P&L to use 1/0 all-aluminum secondaries, this size was applied to all examples. Studies and experience have proved that 1/0 all-aluminum is the most economical size for the Kansas City system.

In the 3-phase examples it was necessary to add the cost of two extra secondary conductors, resulting in a 5-wire secondary. The grounded neutral serves as the third phase conductor.

Both the motor-starting drop and the load drop were calculated to determine which factor would govern the size of secondaries. Voltage drop did not prove excessive in any case.

Standard No. 4 aluminum services were selected for all comparisons. For all 3-phase examples the cost of extra service cable and a polyphase meter was included.

Saturations Studied

For existing areas, the comparisons showed that savings are highest at 4% saturation but decrease, in each example, with increased saturation. The savings are distributed over transformers, primaries, secondaries, services, and metering equipment.

At certain saturations, transformer savings decreased because of a critical loading point. At these points more single-phase transformer capacity was needed, but transformers installed for lesser 3-phase saturations were adequate.

Primary extension savings were highest at low saturations. All primary extensions had been made after saturation passed 4%. Secondary savings, low in all examples, cannot be classed as truly significant.

Savings for services and meters were identical—$35 per unit—for all saturations in all examples. These savings represent a considerable economy and further justify use of single-phase service.

For a new area, total savings for single-phase are highest at 25% saturation and are very nearly the same in each example. Transformer savings are the predominant factor for 25 and 50% saturation. At higher saturations transformer savings decrease and the service cable and meter combination becomes important.

No attempt was made to determine the customer costs involved in the single vs 3-phase comparisons.

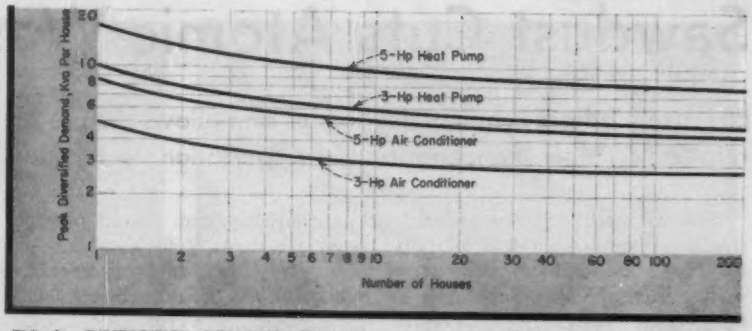


FIG 3—DIVERSIFIED DEMAND CURVES were used as basis for determining diversified load at transformer. They were based on published data and demands

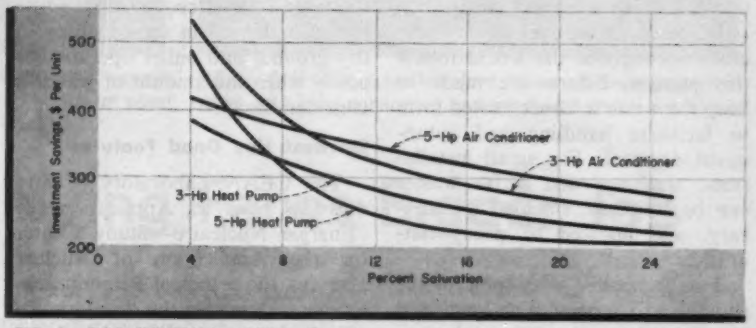


FIG 4—FOR EXISTING AREAS, the comparisons showed that savings of single over three-phase are highest at 4% but decrease with increases in saturation

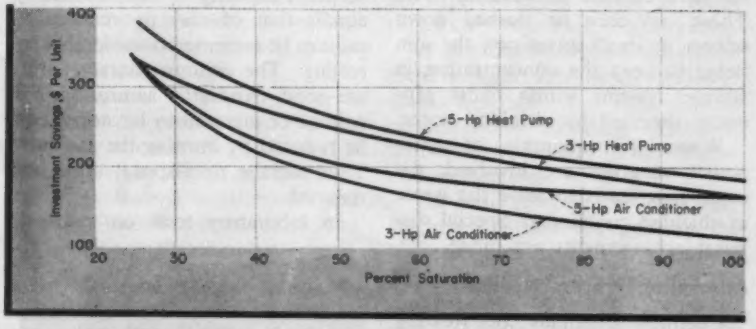


FIG 5—FOR NEW AREAS, total savings for single-phase are highest at 25% saturation. Transformer savings are prominent for 25 and 50% saturation

Sawdust Cuts Atomic Waste Costs

Effectively adsorbs radioactive wastes and allows the use of relatively simple handling and transportation techniques

Sawdust appears to be an effective adsorbent which will simplify handling and reduce radioactive waste disposal costs, according to tests made in Belgium. Present adsorption methods involve heavy, bulky materials, such as concrete or clay, whose handling and transportation are awkward and costly.

Disposal techniques used generally throughout the world follow this pattern: Efforts are made to keep the waste in concentrated form to facilitate handling and subsequent disposal. For small installations, washings and active wastes can be collected, shielded if necessary, and allowed to decay naturally.

This is feasible with some of the short-lived isotopes. For long-lived beta and gamma emitters solutions are usually rendered alkaline and diluted by adding stable isotopes of the same element in chemical form. These can then be flushed down sewers in small quantities, the aim being to keep the concentration in sewage systems within limits generally specified for drinking water.

When larger quantities of radioactive materials are involved, the usual practice is to store the waste in shielded containers. Special disposal arrangements are made.

Adsorption Process Needed

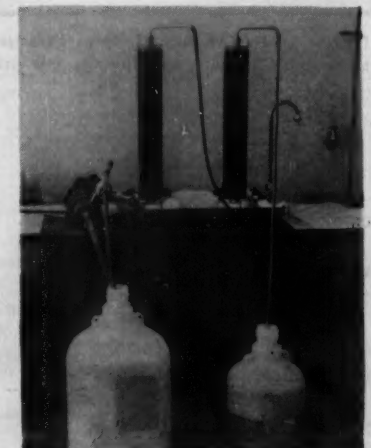
Chemical methods of treating radioactive waste water are attractive because they offer a low-cost means of handling relatively large volumes. But it is difficult to obtain a decontamination factor (ratio of initial to final radioactivity resulting from a separation process) that is adequate in the case of a mixed fission product solution. For this reason, it is useful, in most instances, to complete the chemical treatment by an adsorption process. Adsorption alone, however, is rarely sufficient because of the serious interference of the chemical impurities.

To be satisfactory for treatment of large volumes of waste water, the adsorbent should have good column characteristics and should provide adequate porosity to allow a high flow rate. Clay, which has been investigated in various countries, lacks these properties. Vermiculite, a mica derivative, having a more stable structure than clay, can be used in columns. After saturation, however, the large volume required has to be stored or buried in the ocean or in dry ground, and either operation is costly when the amount of waste is considerable.

Sawdust Has Good Features

The CEAN Laboratory (Centre d'Etudes pour les Applications de l'Energie Nucleaire—Study Center for the Application of Nuclear Energy), the principal Belgium government agency in the development of atomic energy, has studied the use of sawdust in the decontamination of radioactive water. The adsorption capacity of sawdust nearly equals that of clay or vermiculite and can be increased considerably by rotting. The column characteristics are good. And after saturation, the volume of material to be stored can be reduced by burning the sawdust. Thus storage or disposal costs are reduced.

In laboratory tests on sawdust, flow rates of 60 cc (about 3½ cu in.) per hr and higher have been obtained with columns 13 mm (½ in.) in dia and 18 cm (about 7 in.) high. In these small columns, up to 4 liters of strontium-90 solution in tap water were treated to a decontamination factor of 20. Substituting demineralized water for the tap water increased the decontamination factor to more than 100.



LABORATORY SETUP shows experimental two adsorbment columns in series

In another test, a radioactive tap water solution was first chemically treated. This removed about 80% of the activity. One part of the supernatant liquid was sent through a series of five sawdust columns each 18 cm (about 7 in.) high and 33 mm (about 1¼ in.) in dia. The flow rate was 5 $cm^3/cm^2/min$. After each 25 liters the first column was removed and a fresh one installed at the end of the series. The decontamination factor for this arrangement was greater than 20.

The other part of the solution was passed through two sawdust columns in series, each column being 45 cm (18 in.) high and 8 cm (about 3¼ in.) in dia. The flow rate was about 1 $cm^3/cm^2/min$. The decontamination factor was between 100 and 1,000. After 325 liters had been treated, the first column was discarded, the second moved into its place, and a fresh column was installed.

Volume Can Be Reduced

In both experiments, the consumption of sawdust was about 0.6%. Because the volume of the saturated sawdust can be reduced easily to less than 1% by incineration, the net storage space required is less than 0.006% of the total volume of water to be treated.

Increasing the flow rate does not necessarily increase the amount of sawdust used, but lowers the decontamination factor. Thus, when flow rate is increased, it is generally necessary to increase the length of the columns, or to add more columns.

Additional investigation indicates that lignite can be substituted for rotted sawdust. Lignite yields a better decontamination factor and a smaller volume to be stored after treatment is complete.

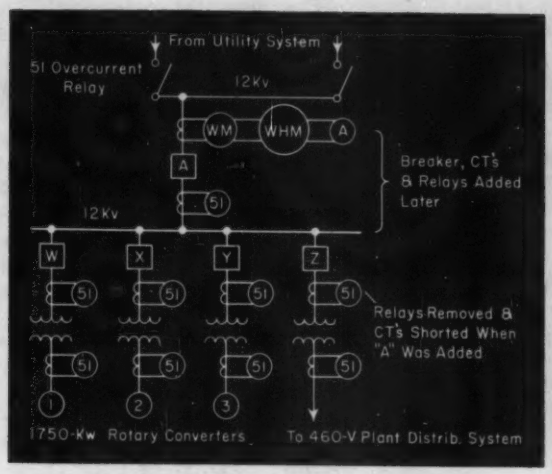


FIG 1—SUPPLY GROWTH may push short-circuit current above branch breaker capacity, let local fault interrupt plant

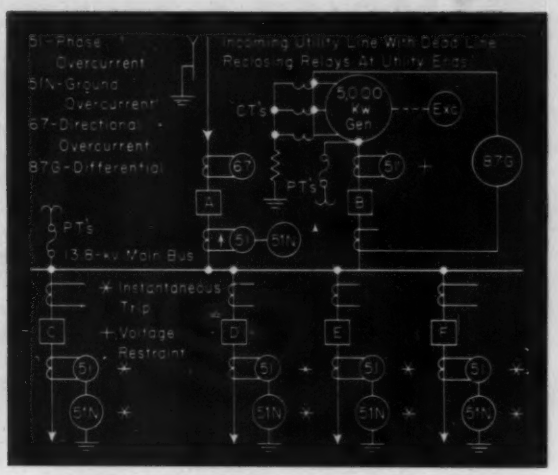


FIG 2—ONE-LINE of typical plant shows minimum protection when both local generation and purchased power are in use

Industrial Relaying Faces Bigger Job

Bigger in-plant systems and higher short-circuit currents make adequate protection and good coordination essential

R. R. PEATFIELD, Electrical Engineer, Stone & Webster Engineering Corp, Boston

An industrial relaying system protects and isolates faulty or overloaded equipment in the shortest possible time without affecting other equipment operating satisfactorily. It may be an inexpensive, simple system, providing only basic protection. On the other hand, it may be an expensive, complex coverage serving any function.

Here, as in most engineering problems, cost and complexity must be balanced against the results desired. Although relays could trip the main service instantly for any fault, this would put the whole plant out of service. Conversely, a protective system designed to isolate a fault without affecting other equipment would be too expensive and complicated.

One of the main criteria of a protective system is adequate interrupting capacity. Increasing use of electric power in industry has produced larger systems and much greater short-circuit currents when a fault occurs. In many plants, it may be necessary to interrupt more than just the faulted circuit because the breaker nearest the fault does not have sufficient interrupting capacity. This is especially true in older plants where the original breakers were not installed with the present high capacity systems in mind.

An example of this situation is the plant diagrammed in Fig. 1. Originally, breakers W, X, Y, and Z were opened by a fault on the 12-kv side of their own transformers and confined the interruption to the faulted branch circuit.

Supply Outruns Breaker Range

As the utility company grew, the available short-circuit currents for a 12-kv fault became more than these breakers could interrupt safely. To adjust to this new situation, breaker (A) with sufficient interrupting capacity was added in the main 12-kv feeder. The phase overcurrent relay for this breaker trips for any fault on the 12-kv side of the transformers. The 12-kv current transformers operating the relays for breakers W, X, Y and Z were short-circuited. CT's on the secondaries were left connected because the short-circuit currents here were low enough to be interrupted without danger by the existing branch breakers.

A 12-kv short circuit on any branch circuit now interrupts the whole plant. But this plant's shutdown is preferable to the risk of the oil fire and damage that would result when one of the branch breakers ruptured while trying to interrupt a current in excess of its rating.

In any industrial plant, the equipment requiring relaying of some sort may be divided into four general classifications: Rotating machines; transformers; lines; and miscellaneous applications.

The basic relaying for ac rotating machines is that required by the National Electrical Code, overload and short-circuit protection. In the simplest case—a low-voltage motor—the overload relay is the heater element in the contactor that opens the motor supply under overload conditions. It is not designed to break fault currents. Short-circuit protection is provided by fuses or circuit breakers on the supply side of the contactor. Similarly, the relay, a trip device to operate these circuit breakers, does not ordinarily operate on an overload.

In the most complex case, involving a large generator and a utility service within an industrial plant, there may be relays for as many as 15 separate protective functions. These include differential current, stator ground, rotor ground, loss of excitation, loss of power, generator motoring, overload, high stator tem-

perature, high rotor temperature, delayed start, unbalanced current, reverse phase, underfrequency, overspeed, and undervoltage.

The minimum NEC requirement for all industrial transformers is protection against overload. Actually, rather than cause a plant shutdown, many plants prefer to shorten the life of their transformers by overloading them for specified short durations.

The more important transformers in a plant may also have differential protection. A modern addition to the transformer differential relay is the harmonic restraint or time-delay feature. This prevents the transformer breaker from tripping immediately after energizing when the inrush magnetizing current may be as high as 20 times the full-load current.

Even the simplest feeders need overcurrent and short-circuit protection to meet NEC requirements. In addition, large, complex interconnected systems may require directional overcurrent (phase and ground), directional distance, balanced current, pilot wire, carrier, and power directional relays to confine the trouble and interrupt only the faulted section of the system. A variety of other relays are for general and special purposes in industrial systems, among them auxiliary timing, over-and-under power, reclosing, synchronizing, synchronism check, and speed matching devices.

Fig 2 is a one-line diagram showing the minimum number and type of relays for a typical plant using both local generation and purchased power. Both supplies are tied in parallel to a 13.8-kv bus. The incoming utility feeder has dead-line reclosing relays at the utility company end.

Breaker A on the incoming feeder may be actuated by either of two relays. Directional overcurrent, phase and ground relays (51 and 51N), set low, protect for faults in the feeder. A reverse power unit (67) with time-delay or underfrequency features prevents generator overloading when the utility's end opens and relays 51 and 51N fail to operate. It can be connected also to trip unessential load when plant load exceeds the generator rating.

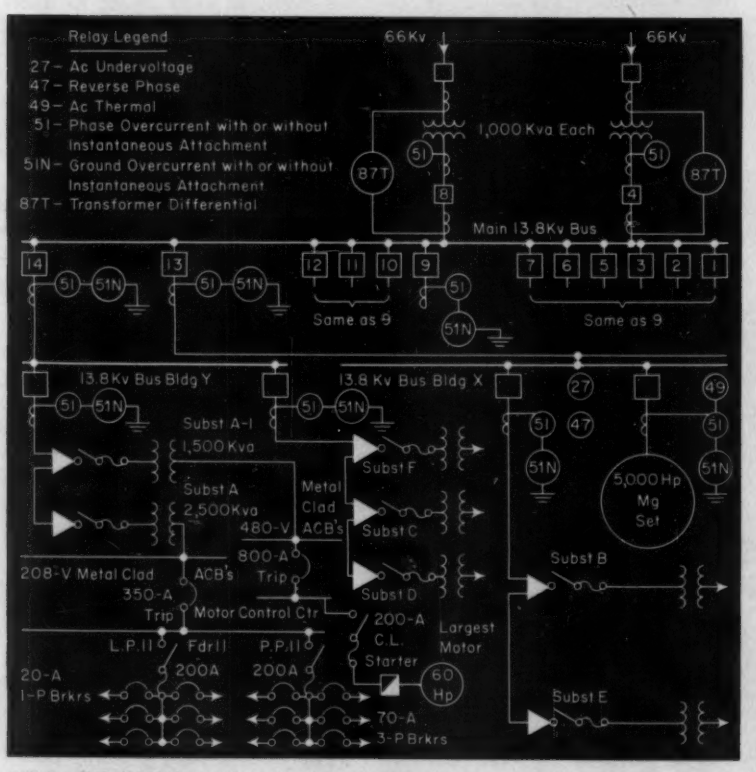


FIG 3—INDUSTRIAL PLANT with variety of loads uses a combination of fuses and breakers. Part of diagram is extended to show low-voltage system protection

The generator breaker (B) is opened by a differential relay (87G) protecting the generator against an internal fault. An overcurrent relay (51) also with voltage restraint, opens breaker B to protect the generator against bus faults. It also serves as a backup unit for all the other relays on the system. Voltage restraint tends to keep the breaker closed except for faults near the generator, when the resulting generator voltage will be low. Finally, each of the four plant distribution feeders is protected by overcurrent phase and ground relays (51 and 51N), with instantaneous trip attachments which open breakers C, D, E, or F.

Elements Have Two Functions

Each element in a protective scheme usually has two functions. First is to clear a fault in its own area of protection; the second, to back up other relays that fail to protect their own areas. Usually the only difference between the two functions is the operating time, which may vary because of different characteristics, operating taps (current settings), or time lever settings. Fig 3 is the one-line diagram of a modern industrial plant. One portion has been extended down to the smallest fuse and breaker on the low-voltage system. The type of each protective element in the system is indicated. Fig 4 is the time-vs-current curves of the phase and ground relay elements in series on the 13.8-kv system.

Fig 5 shows the relationship between low-voltage breaker and fuse elements in series on a typical 480-v feeder and the high-voltage fuses on the associated transformer. Fig 6 shows the comparable relationships for a typical 208/120-v feeder. The curves indicate that for most short circuit currents, the fuses and relays are selective or properly coordinated, allowing the fuse or relay nearest the fault to trip first.

Using relays of the same type or characteristics throughout the protective system increases the number of possible series zones of protection in a given elapsed time. Mixing relay types or mixing relays and fuses reduces the number of possible zones.

Fig 6 is a good illustration of the limitations imposed by using protective devices with different shaped

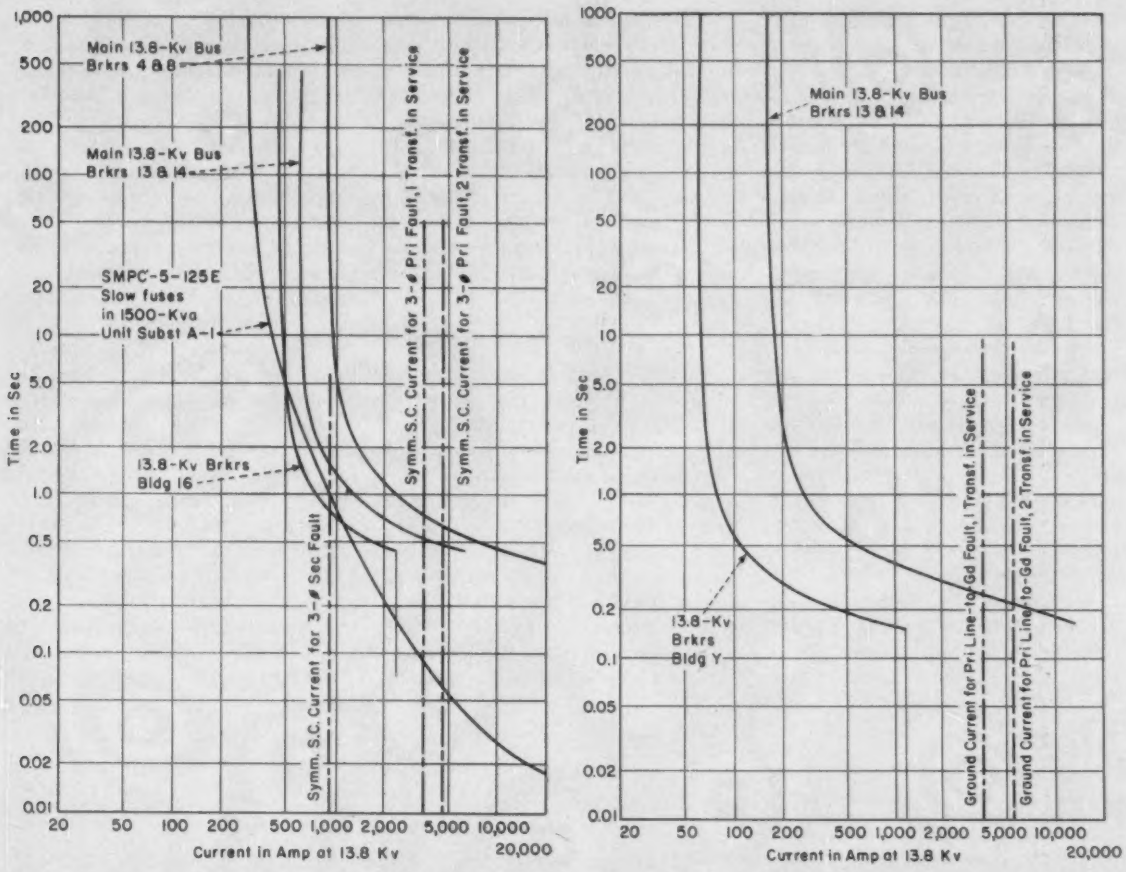

Main 13.8-Kv Bus Brkrs 4 & 8
Main 13.8-Kv Bus Brkrs 13 & 14
SMPC-5-125E Slow fuses in 1500-Kva Unit Subst A-1
13.8-Kv Brkrs Bldg 16
Symm. S.C. Current for 3-ø Sec Fault
Symm. S.C. Current for 3-ø Pri Fault, 1 Transf. in Service
Symm. S.C. Current for 3-ø Pri Fault, 2 Transf. in Service
Time in Sec
Current in Amp at 13.8 Kv
Main 13.8-Kv Bus Brkrs 13 & 14
13.8-Kv Brkrs Bldg Y
Ground Current for Pri Line-to-Gd Fault, 1 Transf. in Service
Ground Current for Pri Line-to-Gd Fault, 2 Transf. in Service

FIG 4—CURVES of 13.8-kv phase (left) and ground (right) relays show disadvantage of mixing dissimilar characteristics. Note small margin time between breakers at 2,400 amp, lack of coordination between fuse and Building-Y breaker

characteristics. Here there are five protective elements in series. Coordination between the 70-amp, 3-phase breakers and the 200-amp, current-limiting fuse is not as good as it should be. If all elements had the same shaped characteristic, as many as eight or ten could be used in series, with a 0.5-sec delay, a good margin time, between each device.

The 13.8-kv system (Fig 4-left) is a further illustration. At 2,400 amp the instantaneous setting of the overcurrent relays in building Y, the margin time between these relays and those on breakers 13 and 14 is only 0.2 sec. Minimum desirable margin time is 0.33 to 0.4 sec.

However, because the two relay curves had to be fitted between the curve for the fuse on the 1,500-kva transformer and the time-current setting required by the utility on breakers 4 and 8, this minimum could not be attained. A second undesirable feature shown here is the lack of coordination between the transformer fuse and the breakers in building Y for current values between 500 and 1,200 amp.

L-V Breakers Cleans Faults

Actually, this last factor is not as serious as it seems in the illustration. The only secondary faults that would be cleared by either of these devices are within the transformer or in the bus between the transformer and the switchgear. This bus is metal clad, with a short throat connection to the transformer. The probability of trouble in these locations is small. All other secondary faults would be cleared by the low-voltage, air circuit breaker. This can be seen on Fig 5, where the characteristic curve for the overcurrent relay in building Y is shown in secondary amperes at 480 v.

A recent addition for low-voltage, metal-clad breaker application in these short-circuit ranges are adjustable, short-time delays, commonly called selective trips. They have the advantage of allowing time for fuses and breakers on a faulted branch circuit to clear before the main breaker trips. This prevents unnecessary loss of power to unfaulted equipment. But in the system shown on Fig 5 and Fig 6, the premium price charged for this feature was not considered to be economically justified.

The low initial cost of fuses makes them very attractive for use in place of breakers on both high and low-voltage circuits. Moreover, they eliminate the need for the overload relays that actuate the breakers. They can be obtained with or without current-limiting features in both high and low-voltage models. A major disadvantage, offsetting the lower initial price, is that failure of only one fuse on a 3-phase circuit

may result in single-phase operation of 3-phase motors, with possible damage to the motors.

The industry has now developed a combination fused circuit breaker to eliminate this possibility for low-voltage applications. It is a low interrupting capacity circuit breaker with built-in current limiting fuses. After the fuse has interrupted the short-circuit current on the faulted phase, the breaker is tripped, interrupting all three live legs and preventing single-phase operation.

A minor disadvantage of fuses is that they complicate the job of coordination. Fuse characteristic curves are both different from and much less accurate than relay curves. The need for replacement and the necessity for a switch in conjunction with the fuse are other minor disadvantages.

With fuses, as with breakers, the first consideration is that they have sufficient interrupting capacity. Ratings of standard NEC fuses are rather indefinite for use on ac circuits. They are rated 10,000 amp on the basis of interrupting a dc circuit with a steady-state current of that value. But low-voltage fuses that interrupt at least 100,000 amp are now available in both current-limiting and non-current-limiting types. Certainly these should be used on the higher capacity circuits now prevalent in large industrial systems.

Use Proper Curve To Coordinate

Published data on fuses may include three different types of curves:

1. The short time-current or "no-damage" curve shows the time and current above which the fuse is damaged and will not blow in accordance with its time-current characteristic.

2. The melting time-current curve indicates the time at which any given current will just melt the fuse.

3. The total clearing time-current curve is the sum of the melting time-current curve and the time it takes the arc to clear after the fuse has melted. Of these three, only the last, the total-clearing time-current curve, should be used in coordination studies.

In applying low-voltage fuses and breakers in series for proper coordination, it is wise to draw the curves as bands with the plus and minus accuracy tolerances expected. For proper coordination of low-voltage, current-limiting fuses with molded-case circuit breakers, the fuse on the source side of the breaker should have at least three times the breaker rating. This is readily seen on Fig 6.

It is now fairly common practice for all the higher-voltage, 3-phase systems in industrial plants to be effectively grounded. The 480-v system is the only range about which there is much divided opinion. A solidly or effectively grounded neutral system provides a path for phase-to-ground fault currents. It

(*Continued on page 70*)

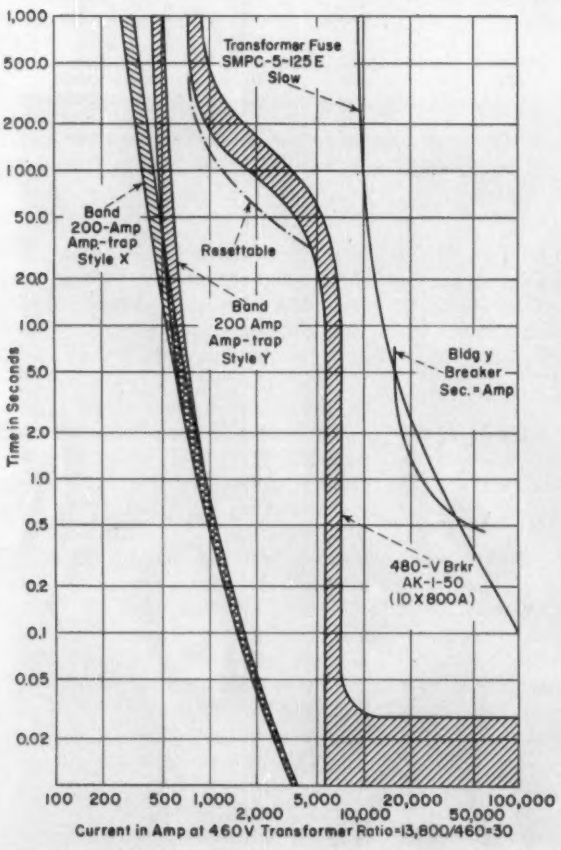

Transformer Fuse SMPC-5-125E Slow
Band 200-Amp Amp-trap Style X
Resettable
Band 200 Amp Amp-trap Style Y
Bldg y Breaker Sec.=Amp
480-V Brkr AK-I-50 (10X800A)
Time in Seconds
Current in Amp at 460V Transformer Ratio=13,800/460=30

FIG 5—480-V AIR BREAKER is partial remedy for lack of coordination between fuse and Building-Y breaker

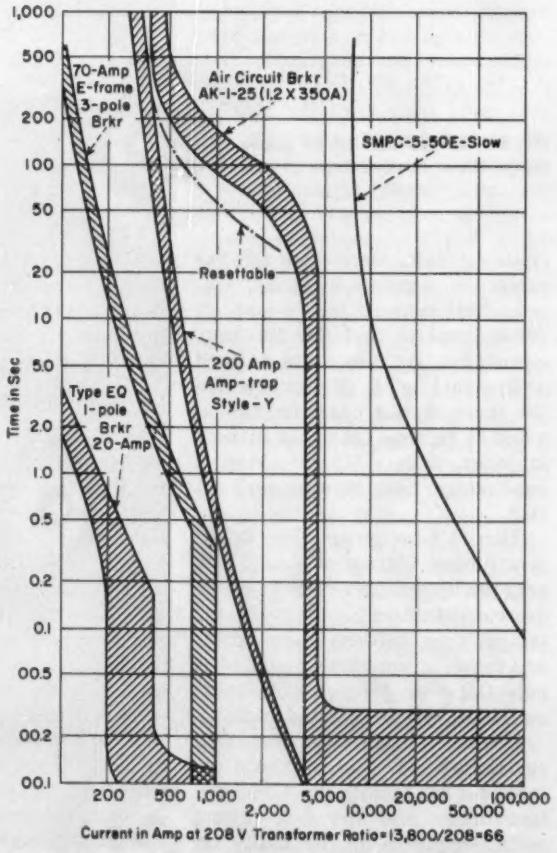
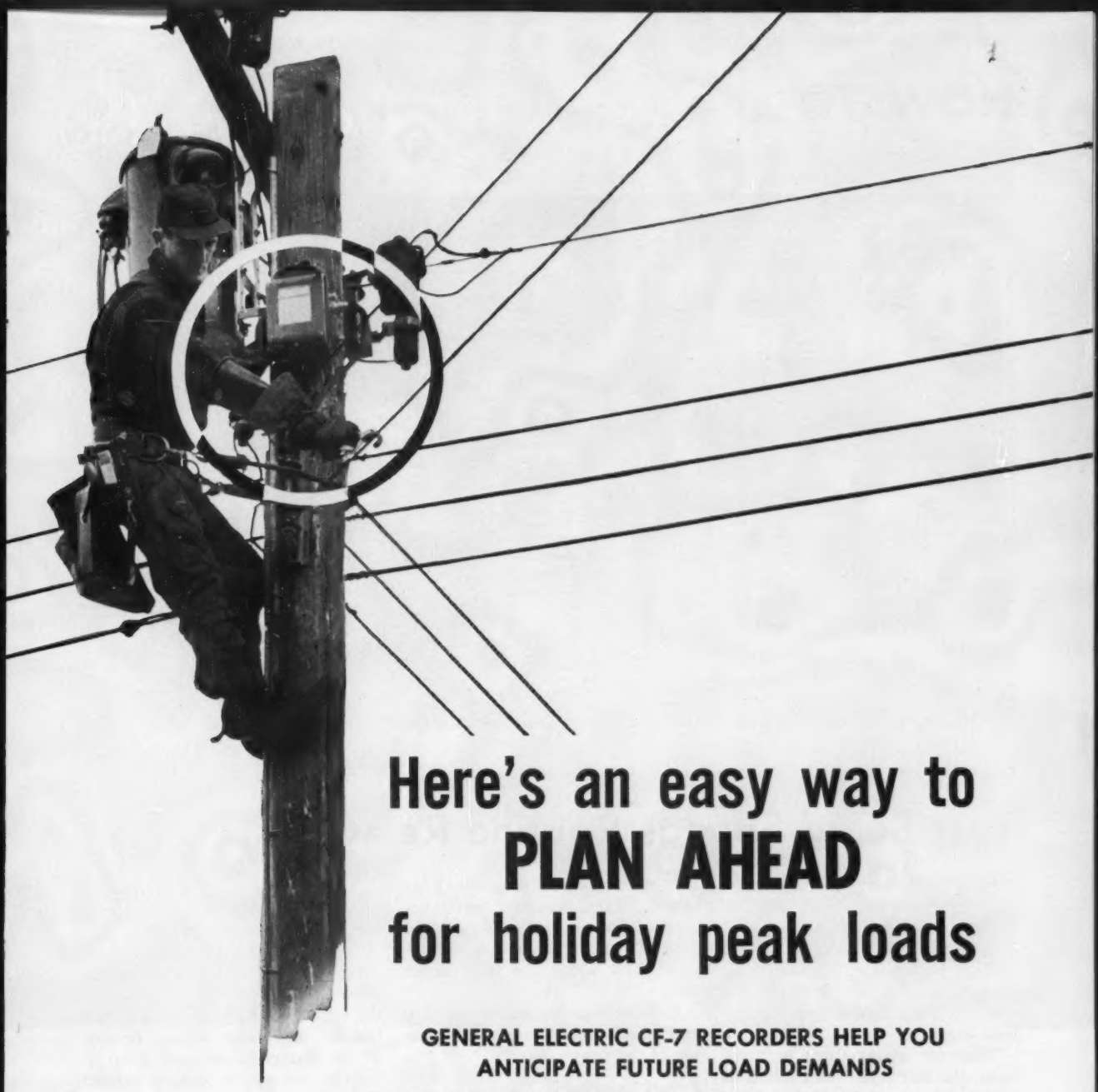


FIG 6—MIXTURE of characteristic shapes on 208-v system limits number of zones of protection, impairs coordination



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The versatile CF-7 hook-on recorder gives you an easy way to chart the variations of troublesome holiday peak demands, caused by maximum lighting, hot-water heater and industrial loads. These accurate records can help you plan your load distribution easily and efficiently. Result: you save money and improve customer good will.

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Fast, Easy Installation: No cutting or splicing required when measuring current; just hook-on the Butyl-molded transformer.

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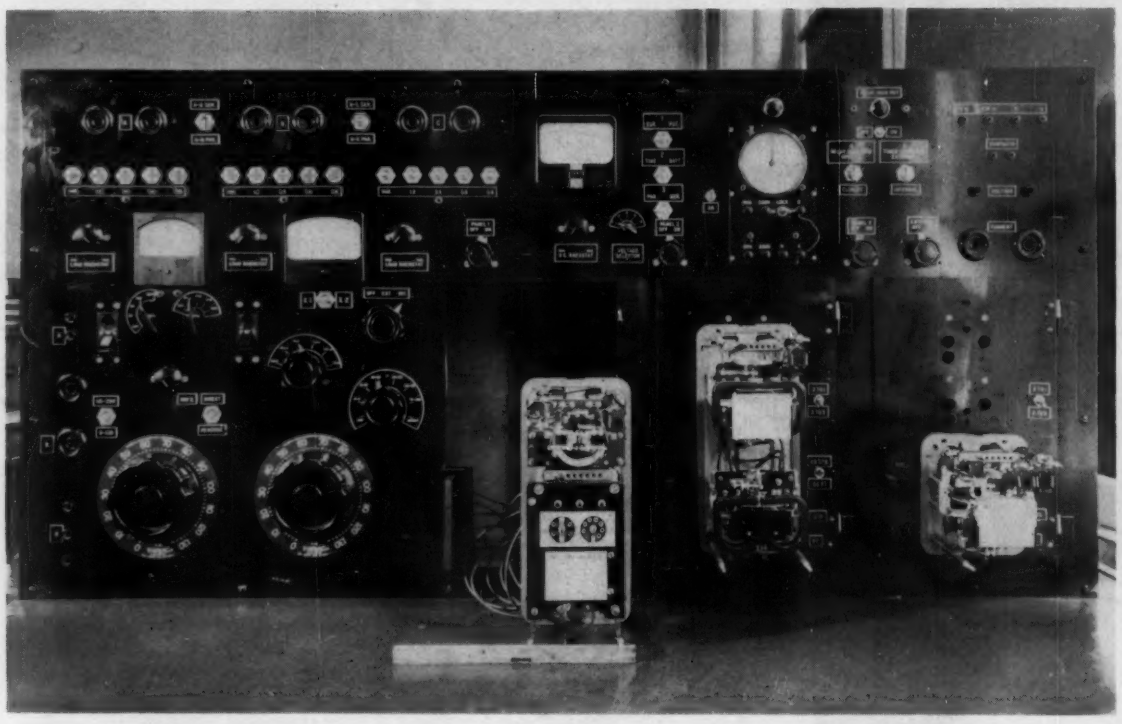
Butyl-molded Transformer Insulated to 8700 Volts

Accurate to 3% of Full Scale

Outdoor Service: Rugged, sealed case; inkless recording; 30-day continuous record without attendance.

To see how the CF-7 Recorder can help you with your load problems, contact your nearest General Electric Apparatus Sales Office or your local distributor; or, write for CF-7 bulletin GEA-6104 to: General Electric Company, Section 582-25, Schenectady 5, New York.

GENERAL ELECTRIC



RELAYING—Testing

Test Board Speeds Routine Relay Tests

WALTER C. ELLIS Testing and Standards Section, Boston Edison Co, Boston, Mass.

A test board constructed for the Boston Edison Co laboratory facilitates the routine testing of station relays through eliminating clip-lead setups.

Used for testing three or more units, the board has been found to increase the productivity of test personnel as much as 50%. The probability of overheating current windings or damaging contacts has been virtually eliminated. It is applicable also as a convenient controlled source for operating street lighting apparatus and miscellaneous equipment.

The test board consists of five independent circuits which may be used separately or in combination to obtain the voltages and current for testing the common station relays. Use of resistance loading minimizes wave-shape distortion. The high-current circuit is transformer coupled to isolate it from other circuits, isolation being desirable when current and potential have a phase difference or a common point within the relay under test.

Low voltage is used on the trip and target circuits to prevent burning of the relay contacts.

Panels Described

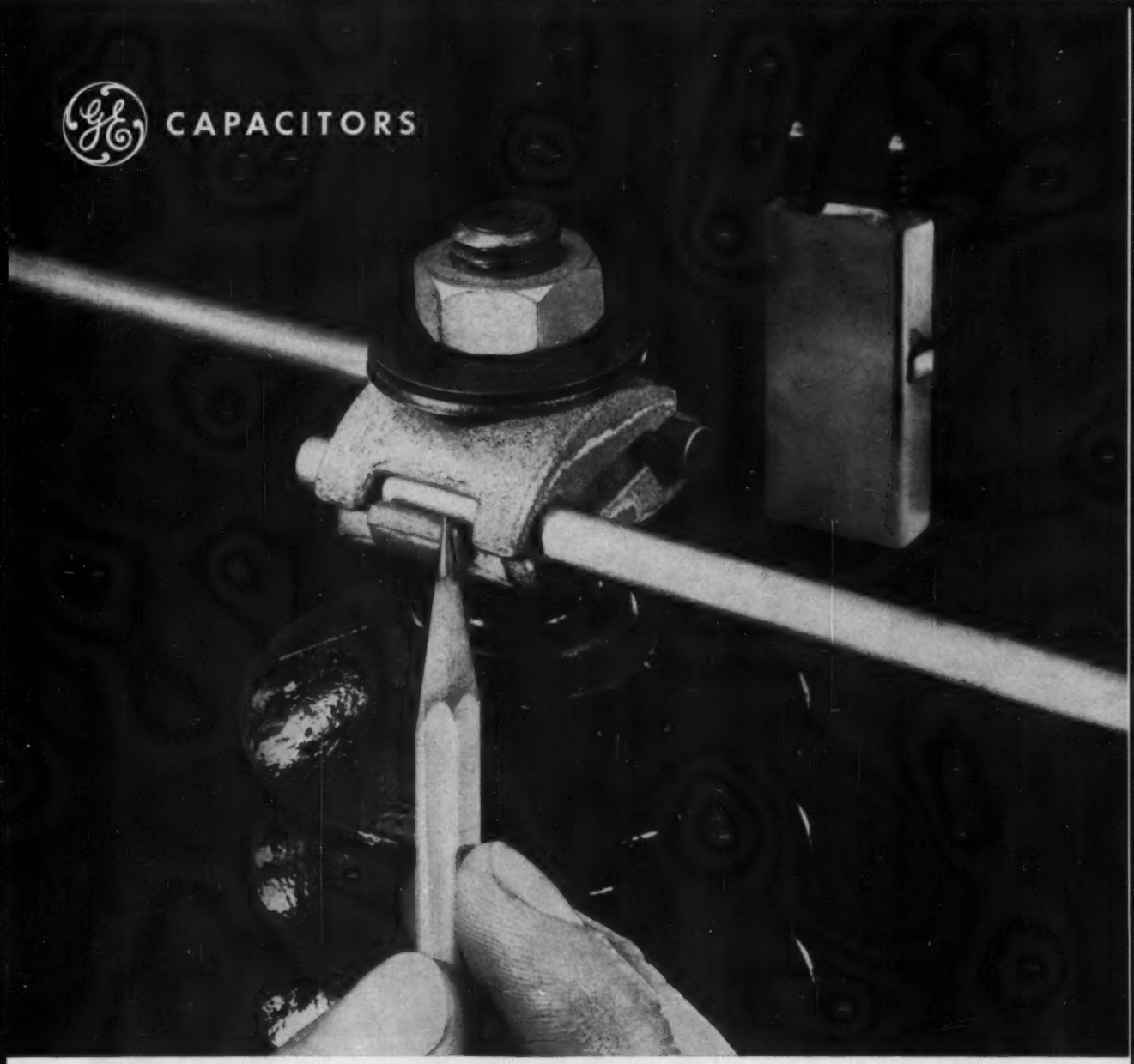
Sub-panels mount over-current and reverse-current relays, so that three units may be processed simultaneously. Small panels connect with the circuits of the main panel through a six-point connector block. Relays are secured to the sub-panels by machine screws or wing nuts which serve also as connectors. Each sub-panel holds several types of relays. One panel may hold CR and CO relays, both flush and surface mounted. Plug units with flexible leads fit the connector block to bring out circuits for testing relays which do not fit on sub-panels.

Incorporated in main panels are:

1. A regulated-voltage circuit supplied by 3-wire 120/240 v. A 20-amp circuit breaker feeds a 2-kva variac whose output goes to a wire-wound potentiometer for precise voltage control. Selector switches transfer the output voltage to any of the test positions, and polarity may be reversed by a toggle switch. A built-in voltmeter with 30, 75, 150, and 300-v scales indicates the voltage applied to the output. The input can be fed from an external phase shifter when desired.

2. A regulated-current circuit supplied by 2-wire 120 v. A 50-amp circuit breaker feeds a 2-kva variac whose output goes to an isolating transformer with a 2:1 ratio and 1-kva capacity. The transformer's secondary supplies the test positions through load resistors. An ammeter on the panel connects to a multi-range CT in the load circuit.

(*Continued on page* 66)



Cold flow gets big squeeze

A capacitor terminal can't stop the cold flow of aluminum conductors, but it can adjust to it. The "big squeeze" provided by General Electric's terminal assembly does just that. Here's what happens.

No matter how the conductor shrinks, expands, or "flows," the jaws of the connector* bear down with a continuous quarter-ton grip. Cone-disk Belleville washers provide this firm, flexible, follow-up pressure that maintains full area contact and helps to keep out corrosion.

The result? No hot joints from corrosion or poor contact, even on switched capacitor banks with frequent thermal cycling. The big squeeze on cold flow is another Engineered Extra you get only with G-E capacitors.

Any questions? Your G-E Apparatus Sales Engineer can probably answer them. Or write to General Electric, Section 445–1, Schenectady 5, New York.

*General Electric's jumbo, parallel-groove connector, ideal for Al or Cu.

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A new feature is a section giving the dimensions of each plier—length of handle, length of cutting knives, width of head, size of point, etc.

This Klein Catalog No. 100 will be of interest to linemen—electricians—good workmen everywhere. A copy should be in the hands of every purchaser of good tools. Write for yours.

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7200 McCORMICK ROAD • CHICAGO 45 ILLINOIS

Speeds Relay Tests

(*Continued from page* 64)

When not in use each test position can be by-passed by means of a shorting switch.

3. Timer and relay trip circuits. The motor of the timer is supplied by 2-wire 120 v. Toggle switches place the control of the timer on either the relay sub-panels or on external jacks. When the timer is on internal control, other switches permit operation by either circuit opening or circuit closing relay contacts and selection of control voltage from either the regulated-voltage or regulated-current circuit. Other positions of these switches apply low-voltage dc to the trip circuits of the relays to operate targets and contactors.

The current can be read on a panel ammeter and varied by means of a rheostat and voltage-selector switch.

4. Three identical resistance load banks are arranged so that each is normally independent. Toggle switches may be used to connect them in series or parallel. They cover a current range of 0.4 to 36.6 amp for single-phase operation. Each unit has a variable resistor which is brought out to a small jack on the panel. When the load banks are connected in wye on 3-phase, a variable 3-phase potential is obtainable at the jacks.

5. An insulation tester. A small transformer connected to the timer motor circuit provides an isolated 230-v circuit for checking relays for grounds and short circuits. A pilot light indicator glows when a fault is found.

GENERATION—Maintenance

Jig Speeds Turbine Grinding Jobs

Grinding of old unit turbines at the Gorge hydro station of Seattle, Wash., City Light has been made easier by this jig. Previously, the operator had to hold the grinder while working on the overhead part of the scroll case. The jig holds the grinder, while it covers a 3-ft circle and can be disassembled and reset in a few moments, according to Bud Tonkyn, station machinist, who developed it.

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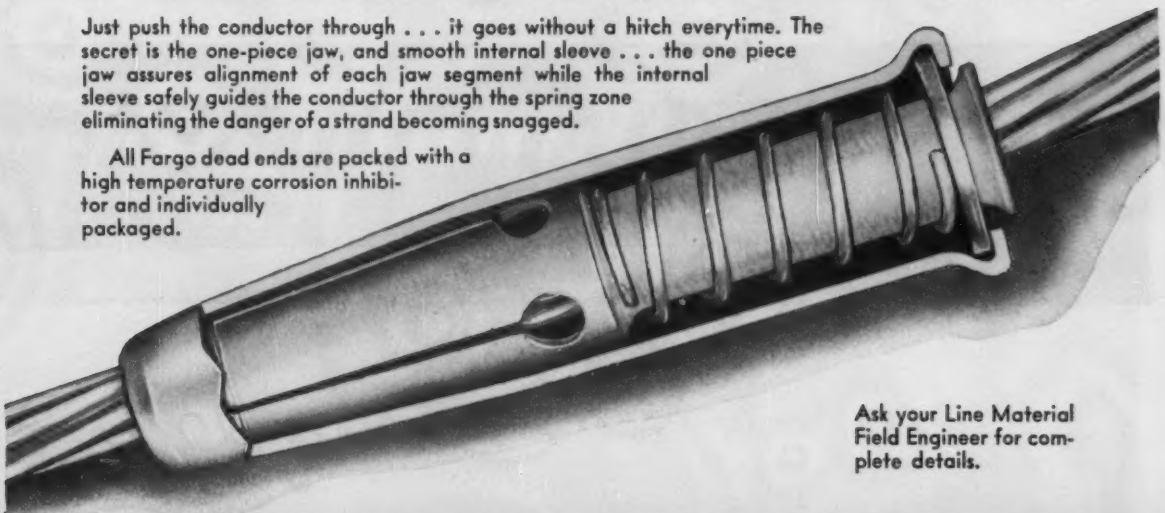

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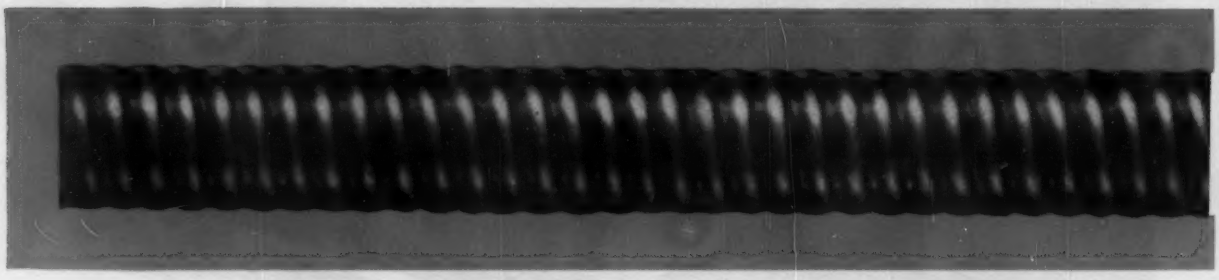
Simplex C-L-X is a Continuous Lightweight eXterior metallic sheath that is impervious to gases, chemicals, and water. Its unique construction gives it a combination of properties that is unmatched by any cable system now manufactured in the United States.

C-L-X provides a completely sealed conduit — with "built-in" cable. C-L-X combines all the advantages of lead sheathed and interlocked armored cables. In addition, it has its own intrinsic qualities of great strength with extremely light weight. It is suitable for installation in trays or by clamps. C-L-X can be used aerially or buried directly in the ground. Its pliability permits ease of installation. C-L-X permits cable buyers to use the most economical cable cores, confident that their installations possess the *safest protection available.*

For more than a decade, this type of cable protection has given exceptional service in European installations. *Now, Simplex engineering has adapted C-L-X so that its scope of industrial applications is practically unlimited for modern American installations.* It is unequalled in situations where impermeability and durability are important.

Like all Simplex products, C-L-X is engineered for lasting quality and, therefore, *dependability.* Write for specific product data.

*(Continuous Lightweight eXterior, pronounced "Sealex")



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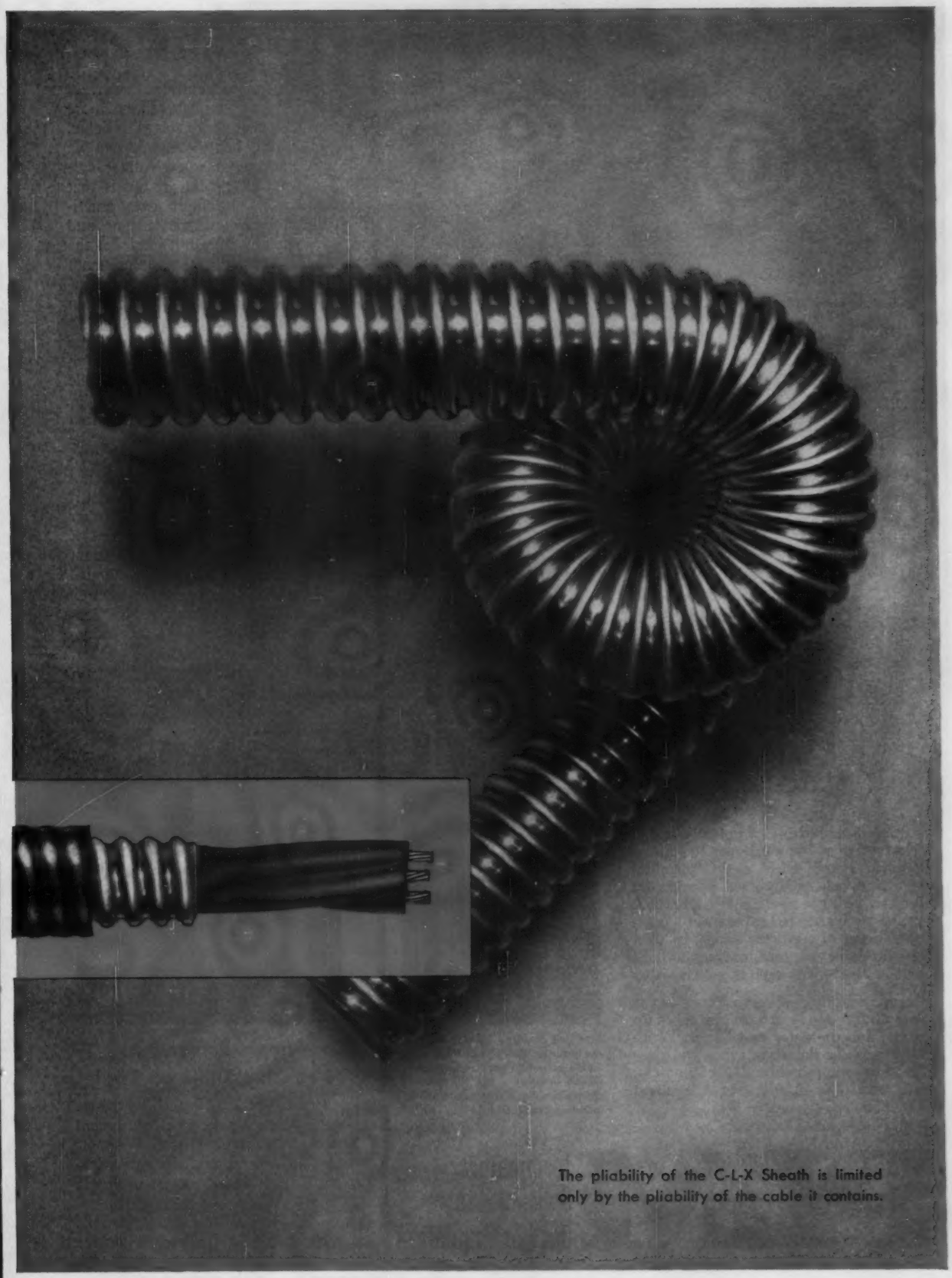

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PLM Unit Package Splicing Kits are available for SIMPLEX CLX Armored Cable as well as for standard interlocked armored cable. Kit contains complete materials for making splice, including casing.

PLM Terminators
Splicing Kits
Conduit Ventilators

Industrial Relaying

(*Continued from page* 62)

permits use of neutral overcurrent relays whose settings can be more sensitive than phase relays to detect a fault and open the faulted section.

Advantage of a low-voltage system without a solid ground is that the first ground fault gives practically no short-circuit current and consequently does not interrupt the circuit. Ground detector equipment indicates when the first ground appears. The system can then remain in service, until there is time to locate and remove the ground. Some equipment now available makes it possible to locate the ground while the system is in service.

An offsetting disadvantage is that the stress on the insulation of the ungrounded phase legs will be 1.73 times normal, although this is not important where 600-v equipment is used on 480-v systems. Another drawback is the possible hazard of multiple ground faults and transient overvoltages due to arcing grounds, switching and lightning surges.

The AIEE publication 952, Electric Power Distribution for Industrial Plants, revised in October, 1956, contains excellent data on breaker, fuse, and relay application.

Consumers Power Puts Poison Ivy Shots on Trial

Field worker Harold Beardslee isn't getting a tattoo embellishment here. Dr. Joseph Guyon is shooting him with poison ivy immunization as part of a Consumers Power Co trial to combat rash and infection. The troublesome plant abounds in the company's Michigan service area.

YOU SAVE 20% IN HANDLING AND JOINING TIME!

KYOVA'S ten-foot lengths save you time, work, money—mean 20% *less handling* in unloading from carrier, loading at your storage area and unloading at the trench. With labor costs rising, consider the importance of these basic KYOVA advantages:

- **KYOVA 10-FOOT CONDUIT saves hours of loading and unloading time**
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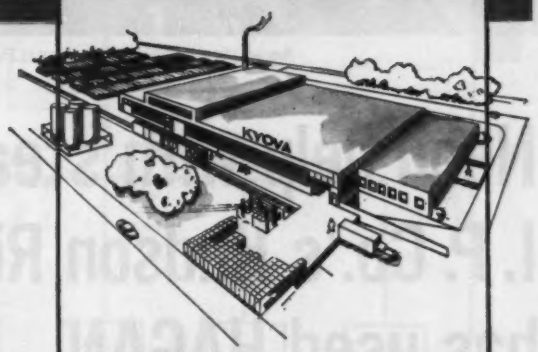
- **KYOVA 10-FOOT CONDUIT requires fewer joints —speeds installation**

KYOVA conduit is light, easy to handle, can be cut with a handsaw. You make joints quickly, easily by tapping couplings onto the conduit's tapered ends. Joints are watertight, safe from seepage. KYOVA offers you 2", 3", 3½", 4", 4½", 5" and 6" sizes, and all accessories. Five-foot lengths are available on special order.



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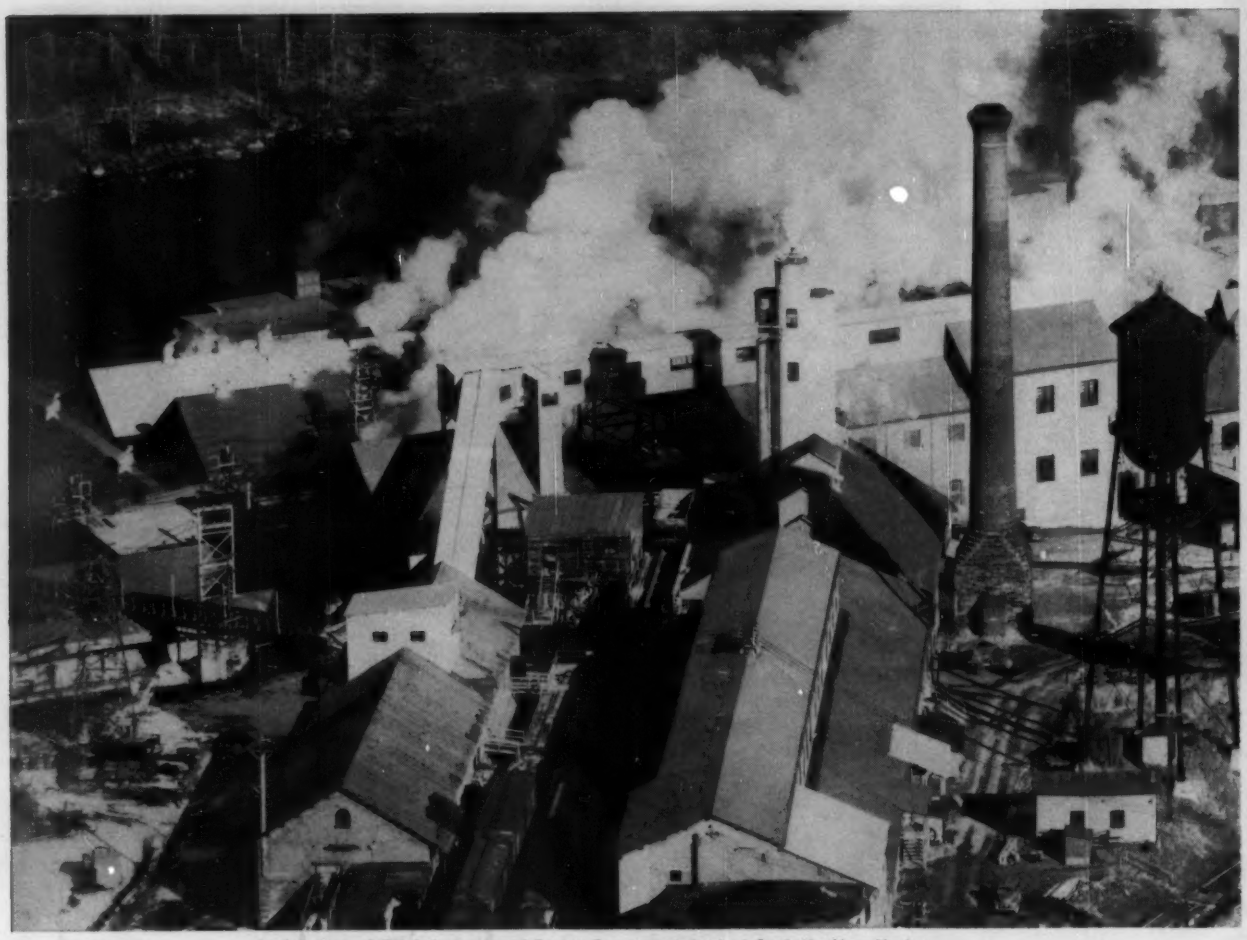


Aerial view of the International Paper Company plant at Corinth, New York

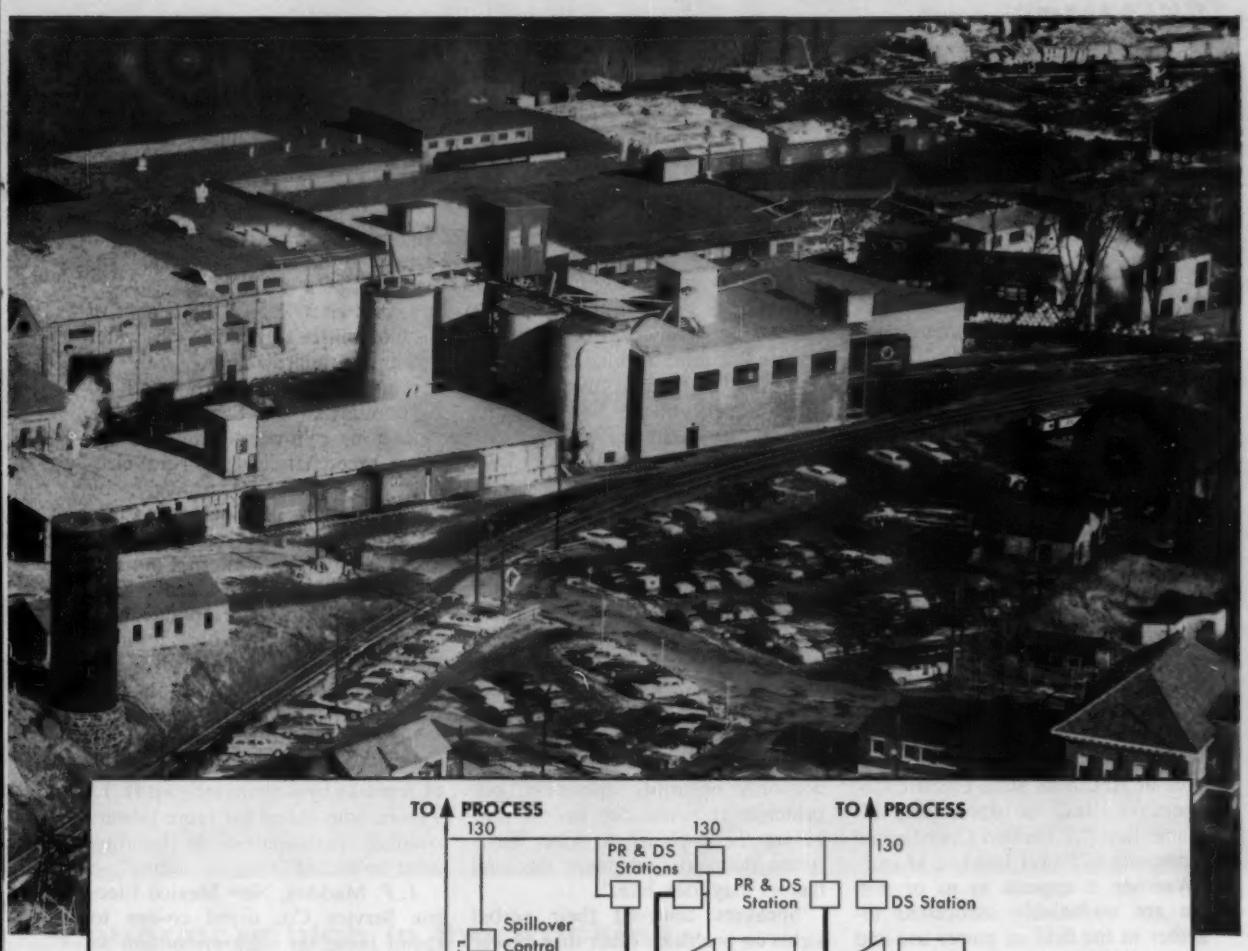
Need help with steam plant expansions? I. P. Co.'s Hudson River Mill has used HAGAN...since 1936

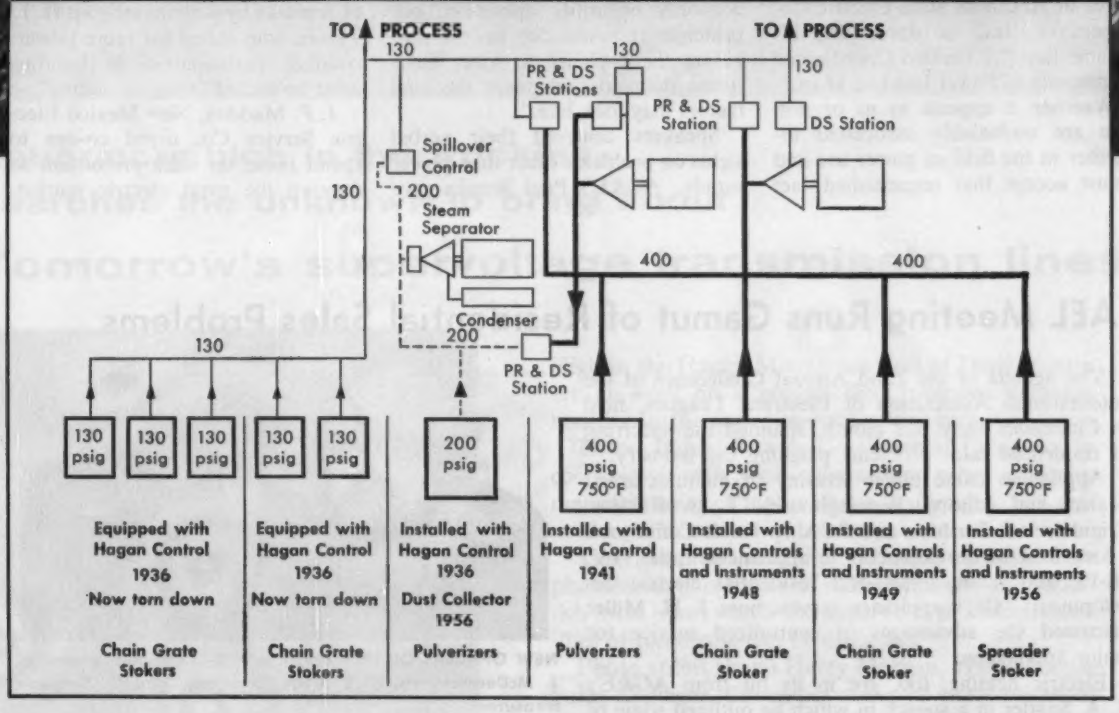
In 1936, the International Paper Company plant at Corinth, New York, decided to install automatic controls on the five boilers then in service (see chronological diagram at right). A Hagan system was chosen for the first three boilers to be converted. Subsequently the remaining two boilers were also put on Hagan automatic combustion control.

Since then, as plant expansions presented new problems of boiler operation and steam distribution, Hagan combustion controls, pressure reducing and desuperheating stations, spillover controls and other systems were added.

Hagan equipment is also used for steam separation, paper machine drying control, water temperature control and chemical feeding systems. In 1956, a Hagan Dust Collector was installed on Boiler No. 7 to control fly ash in the shipping area. Hagan is proud of so long a record of continuous service, and of the results that have been achieved.

Hagan engineers have more than 37 years of experience in the application of accurate, dependable Hagan equipment to combustion control problems of all kinds. Why not put this experience to work on your control problems.





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At Inter-Industry Meet 'Cooperate' is Key Word

REA's Hamil tells utility men, co-ops and manufacturers to work together to meet future rural demand. Merchandising, other problems discussed

All power suppliers must "work together in a spirit of cooperation" to meet the needs of the farmer, REA Administrator David A. Hamil told the 4th Annual National Power Use Workshop-Conference of the Inter-Industry Farm Electric Utilization Council at Denver. The meeting is a joint one among private utilities, co-ops, government representatives, manufacturers and others.

"To meet the farmer's needs is the challenge facing all, segments of the electric industry." Hamil said, "The task is so great that no one portion is capable of doing it alone."

But Hamil's was not the only voice asking for more cooperation. Quote H. L. Oswald, general manager of Arkansas State Electric Cooperative, Inc, in developing his theme that "A Unified Coordinated Approach to Power Use Is a Must,": "Whether it appeals to us or not, we are undeniably associated together in the field of power use and must accept that ungarnished fact if we are to grow and prosper at a rate which is expected of us." And Arizona Public Service Co. president W. T. Lucking: "We have another mutual interest here, because the companies are selling electricity to REA cooperatives at low wholesale rates to make the rural electrification program workable."

Future Demand Most Important

Lucking also pointed out that large future demands will be created by a rising population and greater use per customer. He favors cultivating this with "selective" load-building for the sake of good load factor, but goes on to say "While selective efforts are important for economy of utility operation, our principle responsibility lies in providing the capacity to meet those future demands, whatever the load factors may look like."

Speakers centered their verbal sights on problems other than power supply. AG&E's Paul Brooks gave the rural electric men the benefit of his committee's thinking on water heater standardization, with its recommendations built around 10 basic models (EW, Sept. 30, p 49).

The case for and against appliance merchandising by rural electrics was given, respectively, by E. Livingston of Southern Pines Electric Assn, Taylorsville, Miss., and L. L. Wick, Western Cooperative Electric Assn, Wakeeny, Kan. Small suppliers seem to have the same problem as big utilities: how much are the dealers doing?

And what the dealer is doing depends to large extend on how much help he is getting from power suppliers in this area. This is the gist of remarks by Kelvinator's vp H. L. Travis, who called for more power-supplier participation in building what he called "creative selling".

J. F. Maddox, New Mexico Electric Service Co, urged co-ops to spend more on sales promotion to develop the rural electric market.

IAEL Meeting Runs Gamut of Residential Sales Problems

The agenda of the 22nd Annual Conference of the International Association of Electrical Leagues, held in Cincinnati early this month, spanned the spectrum of residential sales problems plaguing the industry.

Appliances came under scrutiny of manufacturers, dealers and editors. Westinghouse's T. B. Kalbfus, Frigidaire's J. Rushton and RCA vp R. N. Coffin took a long look at developments in appliances, radio, TV, Hi-Fi, and other crystal-ball residential electric developments. GE's appliance service boss J. H. Miller discussed the advantages of centralized service for major appliances.

Electric heating, too, got in its bit from AG&E's E. A. Snyder in a speech in which he outlined some of its potentials (see p 87).

National Wiring Bureau's new commercial wiring program was sketched for conferees by Pennsylvania Power and Light Co's E. P. Werly.

Cincinnati G&E helped host the program. Vice President J. Reed Hartman welcomed the conferees, and advertising manager E. W. Hodgetts made a presentation on CG&E's very successful "House in the Clouds" exhibit.

NEW OFFICERS OF IAEL are, l to r, G. L. Hogan, president, J. McDermott, vp, H. E. Cook, secretary, and G. Simpson, treasurer

(*More Selling on page* 87)

Laboratory high in the Rockies searches the unknown to bring about

Tomorrow's supervoltage transmission lines

High in the Rocky Mountains west of Denver, men are at work on a project that promises valuable benefits to the entire electric utility industry.

There, Public Service Company of Colorado, in cooperation with Westinghouse and other company manufacturers of high-voltage equipment, has created a giant outdoor laboratory.

Their purpose: to study and measure the elusive phenomena of corona and radio influence, and establish facts upon which the supervoltage transmission lines of tomorrow can be designed.

Photo at left shows Harry Morgan, Westinghouse Sales Engineer, discussing some of the equipment under test with L. M. Robertson, Chief Electrical Engineer and sponsor of this project for Public Service Company of Colorado.

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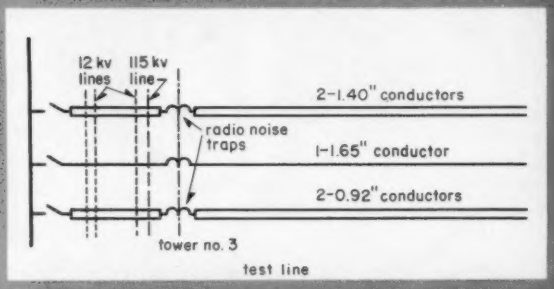
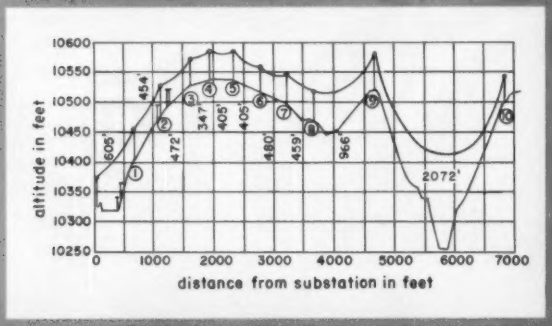
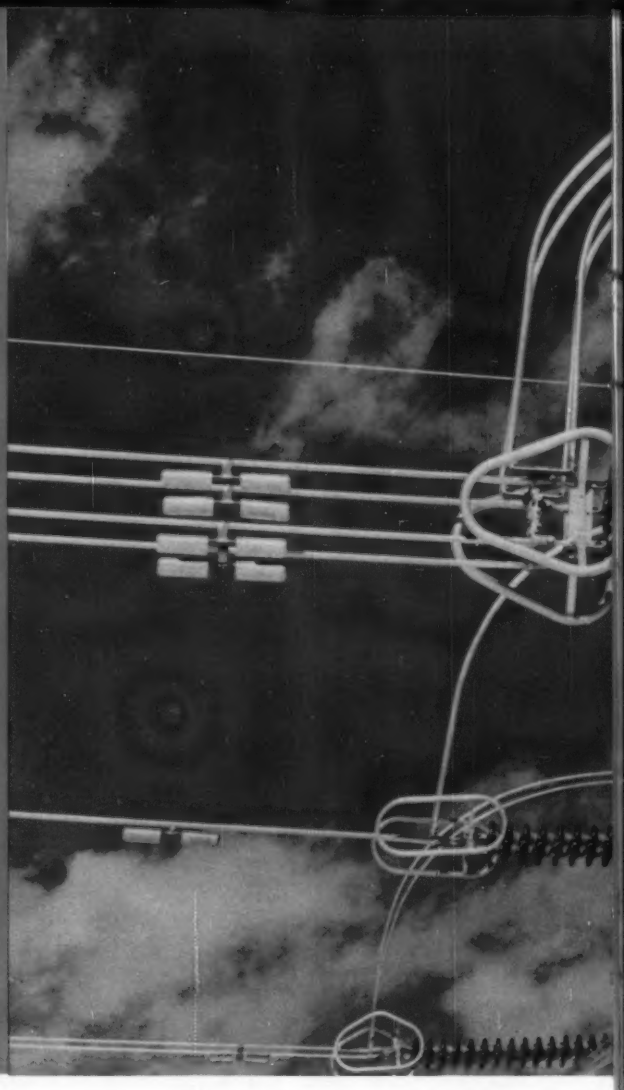


Schematic diagram of conductors as they will be tested, showing the radio noise traps at Tower No. 3 to isolate the test line from radio influence of nearby transmission lines.



Profile of the Leadville test line illustrates altitude of tests. Note foreshortening of distance from substation.



Close-up of Tower No. 3, high over Leadville. Largest conductor is the single conductor in the middle, a duplicate of Tidd conductors. The four-bundle in the foreground is medium size, later to drop to two-bundle for testing. The two-bundle conductor in the background is the smallest line size under test.

500,000-volt corona tests are now underway in the Colorado Rockies

Extra-high voltages will be required for economical transmission of the electrical industry's rapidly mounting energy requirements. Westinghouse is now prepared to supply much of the equipment required to handle these voltages. But the entire industry is aware that additional information is still needed regarding corona and the resulting energy losses, as well as the radio influence it creates at high altitudes.

The AG&E tests at Tidd Station made great strides. Additional performance data gained at Leadville, it is hoped, will make ehv practical not only system-wide, but nationwide.

With line construction and instrument calibration now completed, Public Service Company and its collaborators are embarking on the actual tests, ranging upward from 173 to 500 kv.

Towers carry three single-phase circuits, data later to be correlated to three-phase. Circuit No. 1 bundles four 1.40″ conductors. No. 2 carries one 1.65″, and No. 3 bundles two 0.92″. All conductors except the latter are expanded ACSR.

The four-bundle circuit, having adequate conductor for zero corona at the voltages under test, served to develop reliable data for instrument calibration. On completion of calibration, this circuit will drop one line to run brief tests as a three-bundle and, finally, will drop one-third to get comparative data with two conductors.

Energy loss and radio influence will be measured under violent extremes of weather

The test site at Leadville was selected because the altitude averages 10,500′, with temperatures ranging from high 80's to 30° below. Test lines are sub-

For direct correlation of data, not only are two of the conductors designed to duplicate Tidd tests, but the Westinghouse transformer, arresters, disconnects and measuring equipment were shipped directly from Tidd to Leadville, Colorado.

ject to wind velocities, rain, snow and atmospheric conditions that would be difficult to simulate for components in a laboratory; impossible to recreate for an entire transmission line. Existing data concerning the effect of altitude (low barometric pressure) on corona are based on work with relatively small conductors in evacuated chambers.

Two-mile high Leadville tests will extend knowledge gained in Ohio Valley Tidd Project

No. 2 and No. 3 circuits at Leadville, carrying one 1.65″ conductor and two bundles of 0.92″ conductors, are designed for direct correlation with data gathered on these conductor sizes at Tidd Station. The Westinghouse substation equipment transformer, arresters and disconnects were originally furnished for the Tidd tests. At the conclusion of the Leadville test, this same equipment will be used in the AEIC high-voltage cable test program.

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cooperates with Public Service Company of Colorado to move back transmission frontiers

Westinghouse is proud to be a member of the participating manufacturers collaborating with Public Service of Colorado. Some of the Westinghouse equipment furnished is shown here. But more important is the knowledge to be gained . . . basic knowledge for the benefit of the entire industry . . . unequalled experience in ehv equipment to influence designs of the future.

With this telescope located in the station house, Jim O'Neil takes a direct reading on the instruments on top of the transformer as a cross check on the recorder located in the "nerve center."

Harry Morgan of Westinghouse is shown with L. M. Robertson, Chief Electrical Engineer of Public Service, at the upper level of the substation. Note the instrument panel on high-voltage bushing which reports current and voltage at start of line.

LEFT: Nerve center of the "great outdoors laboratory." James O'Neil, Westinghouse Engineer, and Joseph Wissenbach, Communications Engineer for Public Service, are shown checking the charts that record: (1) conductor temperature, (2) air temperature, (3) dew point, (4) barometric pressure, (5) wind direction, (6) wind velocity, (7) line voltage, (8) line current, (9) corona loss in kw, and (10) radio influence.

RIGHT: Another of the double-check points. Jim O'Neil and Joe Wissenbach inspect the radio influence detection equipment located at the base of the main transformer.

LOWER RIGHT: Radio influence meters are located at various distances from line. To protect them against the extremes of weather, without damping their sensitivity, they are enclosed in temperature-controlled all-plastic huts.

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C. F. WAGNER,
Consulting Engineer
Engineering & Service Dept.
AIEE Fellow, CIGRE

W. E. PAKALA, *Advisory Engineer*
Research Laboratories
Member: AIEE, IRE

D. F. SHANKLE,
Engineer-in-charge
Advanced Development Group
Member: AIEE Committee on Switchgear
AIEE Standards Committee
NEMA Power & Communication Co-ordination Committee

J. K. DILLARD, *Manager*
Electric Utility Engineering
Member: AIEE Committee on Transmission and Distribution
Chairman, AIEE General Systems Subcommittee
Vice-Chairman, AIEE Committee on Power Rectifiers

T. J. BLISS, *Engineer*
Electric Utility Engineering
Associate Member: AIEE

H. S. SHOTT, *Consulting & Application Engineer*
Electric Utility Engineering
Member: AIEE

J. E. O'NEIL, *Engineer*
Advanced Development Group
Associate Member: AIEE

B. J. SPARLIN,
Laboratory Engineer
Radio Influence Laboratory
Member: AIEE

The Extra-High Voltage tests

...another example of the Westinghouse "Plow-Back" policy

It has been a consistent policy of Westinghouse for years, to invest time, talent and money in the development of new knowledge as well as new equipment for the industry. While tests continue in the High Voltage Laboratory in East Pittsburgh and in divisional laboratories throughout the company, proving out new equipment, research teams working with the nation's electric utilities explore the industry's unknowns.

The Westinghouse engineers co-operating on the Public Service of Colorado tests are shown above.

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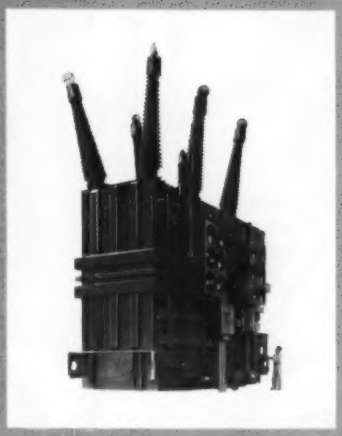
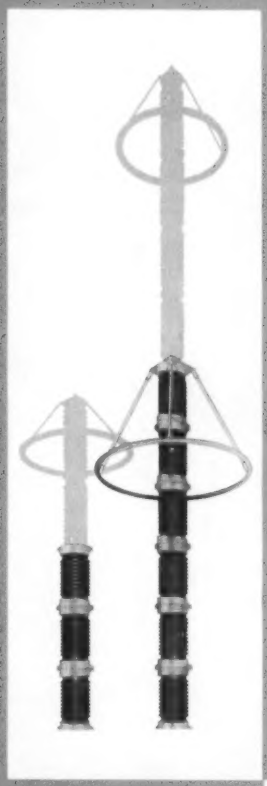


400,000-kva autotransformer

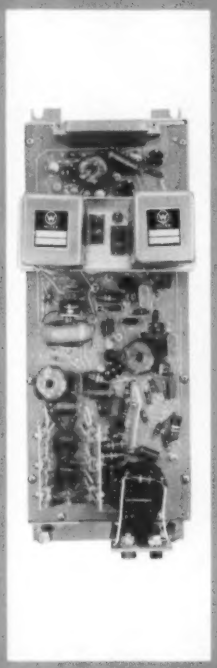
25,000,000-kva power breaker

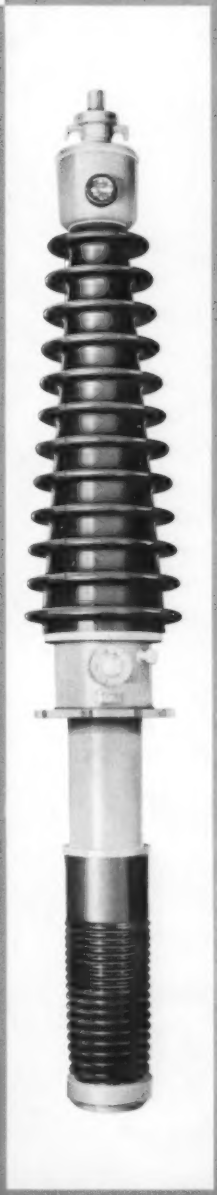
K-24 instruments—600 kv



182-kv lightning arrester

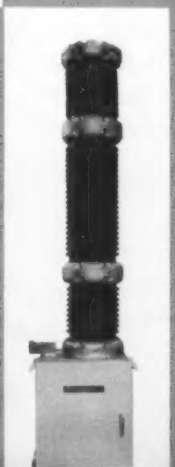
Completely transistorized carrier





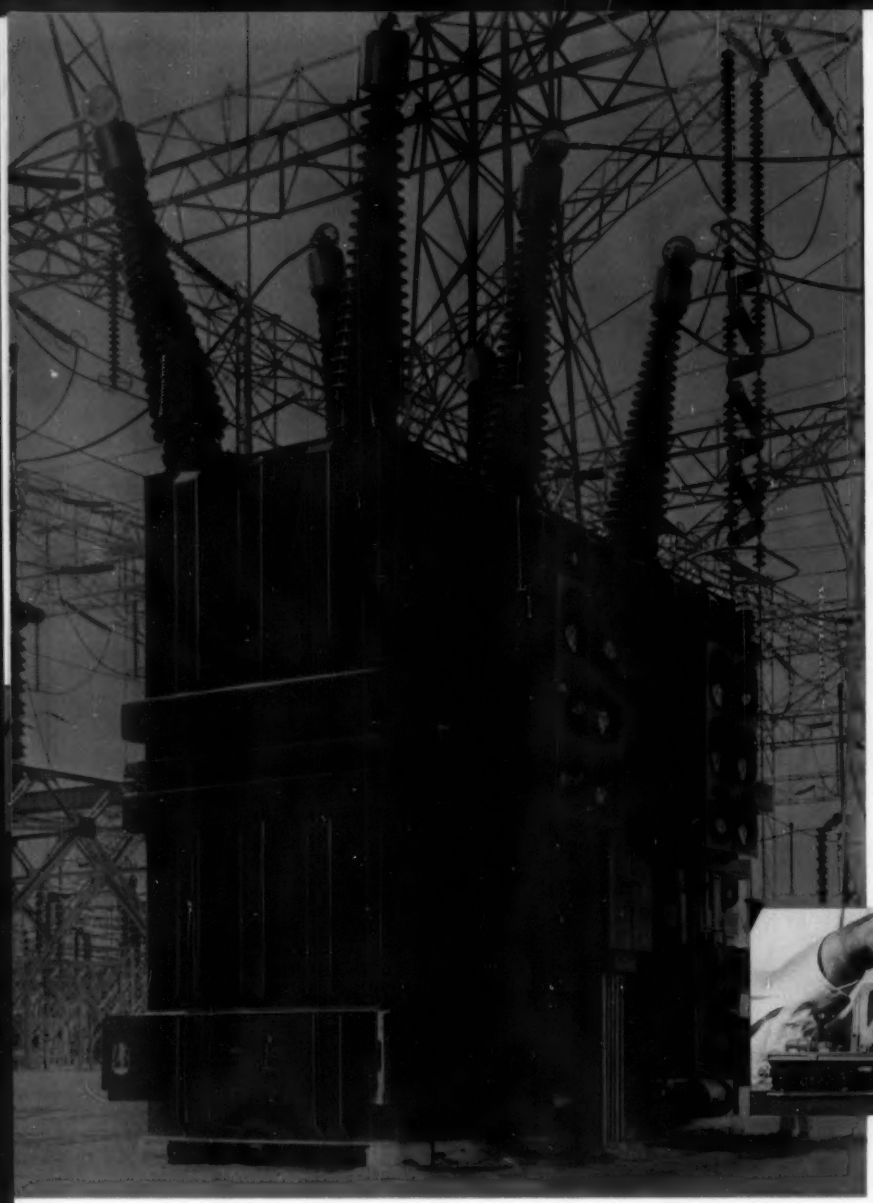
Type "O" Bushing—92-345 kv

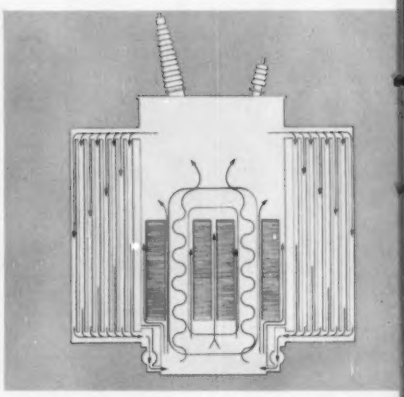
The Westinghouse "Plow-Back" policy has already resulted in equipment now ready for supervoltage transmission



196-kv high-speed grounding switch

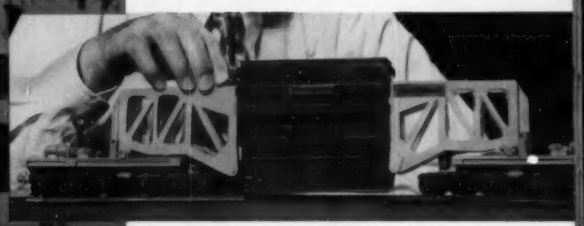
K-Dar compensated relay system





Close-fitting tank and vertical coil construction of Form-Fit transformers combine to form directed paths for coolant. Forced-oil cooling eliminates need for thermal head, provides maximum coverage of coil surfaces within minimum space.

Shell-form construction places core on the outside, coils inside for maximum mechanical strength. Solid insulation is used at high stress points; creepage surfaces eliminated.



New Westinghouse-designed transformer railroad car will permit more direct routing . . . faster delivery to help speed your construction schedules. With the transformer suspended only six inches above rails, and with a capacity of 250 tons, this car, the "Schnabel," provides additional room to grow . . . will permit transformers of the supervoltage era to be shipped in one piece.

From design to delivery...

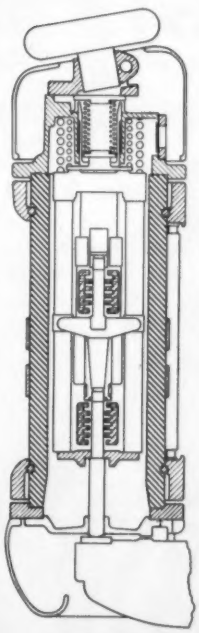
Transformers with room to grow meet the challenge of ehv* future

Extra-high voltage transmission of the future presents no problems for Westinghouse transformers. Utilizing the basic "Form-Fit"® design with forced-oil cooling, these transformers are both smaller and lighter per kva than any other design. Here is a design with room to grow . . . a principle that can be extended to any foreseeable voltage level . . . meeting the challenge of the supervoltage future.

Westinghouse can now build transformers with voltages practical for the next decade . . . voltages up to 380, 440, 500 kv or beyond.

*extra-high voltage

Westinghouse high-power laboratory made possible world's first 345-kv breaker, paved way for ehv



Developed in the Westinghouse high-power research laboratory, the tubular, multi-break interrupter made possible the world's first 330-kv, 25-million-kva circuit breaker. This development has made practical the extension of circuit breaker ratings into still higher voltages; it will pave the way for solution of problems involved in handling extra-high voltages . . . supervoltages of 500,000 and above.

ultra-high-speed reclosing can be extended to ehv breakers

Trouble-free, trip-free service is provided by pneumatic operating mechanisms in Westinghouse circuit breakers rated to 345 kv. Both mechanically and electrically trip-free, breakers trip open in standard operating time when closed on a fault. Reclosing is fast—just 15 or 20 cycles. Automatic selection of trip-free or non-trip-free operating results in ultra-high-speed reclosing for larger breakers.

These are some of the benefits you can expect to find extended into the supervoltage future.

Now in use in breakers up to 345 kv, the tubular interrupter grids also have excellent line-dropping and capacitor-switching characteristics—proved in laboratory and field tests. *Additional tests have proved the performance of this interrupter at even higher voltages.*

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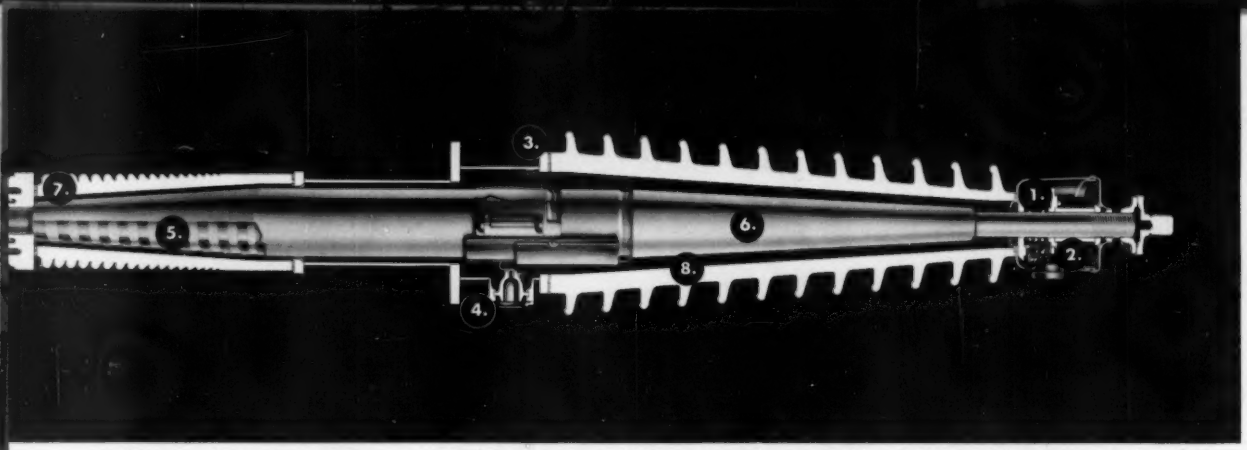


1. Compression spring assembly 2. Inert gas space 3. Concentric gasket assembly 4. Potential tap receptacle 5. Concentric foil layers 6. Oil-impregnated condenser 7. Porcelain arc shield 8. Porcelain weather casing

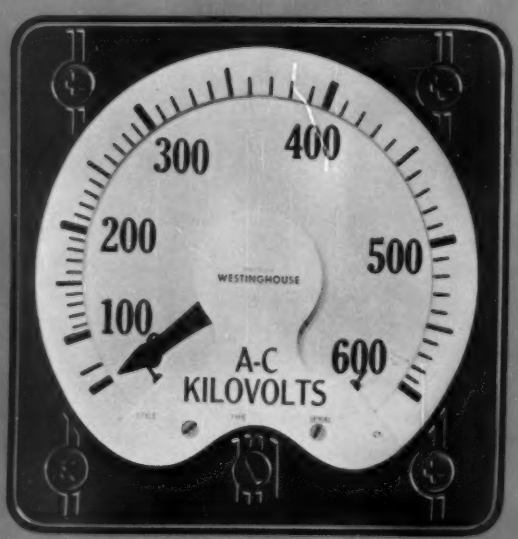
Fifty years' bushing dependability builds toward corona-free ehv

As demands on power equipment go up and up, so—ordinarily—do the problems of corona. But the Westinghouse Type "O" bushing used for breakers and transformers in the higher voltage range—92-345 kv—is far from ordinary.

The Type "O" bushing is corona-free. It has greater dielectric strength than any other bushing made; vacuum oil-impregnation of the condenser insures insulation with the highest possible strength in a minimum of space.

Westinghouse pioneered the condenser principle, has designed, built and improved condenser bushings for 50 years, building toward the era of supervoltages, building toward corona-free ehv bushings.

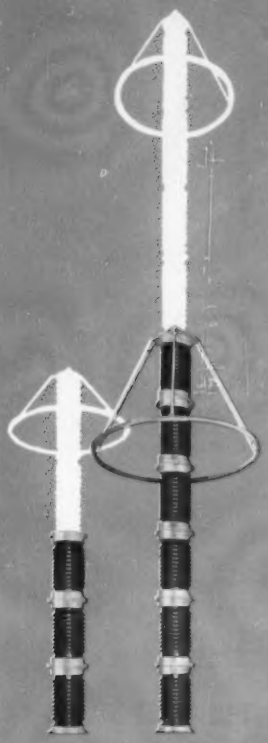
Seeing is believing with super-legible K-24 instruments



Important electrical data is gathered by accurate instrumentation . . . and costly errors must be avoided. Westinghouse K-24 circular-scale instruments—designed to help eliminate these errors—can be read at distances of 20 feet or more, at angles up to 65 degrees. Shadow-proof and glare-proof, the dials of K-24 instruments keep distortion of readings at a minimum.

The long scale, coupled with small flange area, increases readability and saves space—K-24 instruments can be grouped compactly in higher banks, do not have to be spread out at a lower level. K-24 instruments simplify one-man operation.

Accuracy for the future. This K-24 instrument dial for extra-high voltage applications provides a good demonstration of how great even the smallest error can be. Each division on the dial represents 10 kv. Excellent legibility practically eliminates chances of misreading dial.



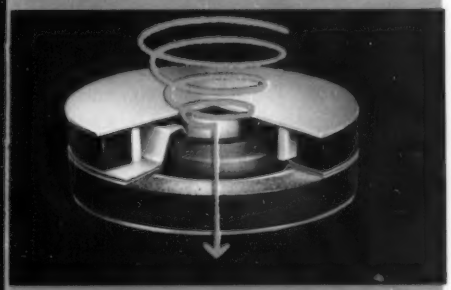
The new reduced-height type SVS arresters are self-supporting; installation is simpler—up to 300,000 pound-inch cantilever strength.

Westinghouse shrinks arresters, tailors height and performance to tomorrow's supervoltages

The constant increase in the physical size of lightning arresters resulting from ever-rising voltages could have caused a critical space problem. But Westinghouse engineering came to the rescue . . . developed an arrester design that not only reduced the height of arresters for present high-voltage ratings, but provided room to grow for the supervoltage requirements of the future. The height reduction—up to 45 percent—from this new design stems from physically paralleled elements, connected in series electrically.

At the same time, greatly increased operation due to switching surges called for a means of preventing pitting and other damage to the gap electrodes. This was achieved with development of the new Mobilarc gap, utilizing a radially polarized magnet which spins the arc around a longer path on the gap electrode surfaces. Due to the movement of the arc, the electrodes are not affected . . . maintain their original condition. Currents of 100,000 amperes have been discharged through the gaps without changing the permanent magnetic field.

These two developments have resulted in better performance packed into a smaller arrester . . . another example of Westinghouse designing for the supervoltage future.



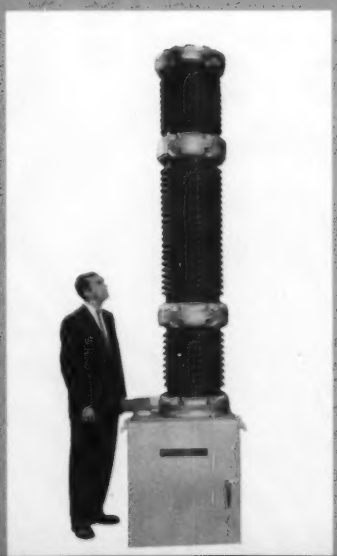
The Mobilarc gap safely spins the arc over the electrode, with no change in gap characteristics—even after 1,300 tests.

Faster, better protection for your transformers of the future

The new Westinghouse high-speed grounding switch closes in five cycles—six times the speed of conventional grounding switches. This revolutionary unit initiates a ground fault which trips remotely located circuit breakers, clearing the line before extensive transformer damage can occur. Closing time is minimized by locating the contacts relatively close together in a high-dielectric sulphur-hexafluoride (SF-6) gas atmosphere, and by providing reciprocal blade action instead of swinging action.

Contacts and mechanism are fully enclosed—impervious to weather. Speed and reliability are maintained even under conditions of severe icing and with temperatures as low as —40°F.

The grounding switch in ratings up to 196 kv is protecting today's transformers from damage. With the design principle of this switch, ratings can readily be increased as needed to afford this same protection to tomorrow's supervoltage equipment.



This 196-kv grounding switch is one of two built by Westinghouse for Pennsylvania Power & Light Company's Peckville substation. This unit is capable of closing a 20,000-ampere circuit in five cycles.

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Extra-High Voltage transmission puts new emphasis on reliable carrier communication

Accurate decisions in a utility have always depended upon quick, accurate transfer of information from remote locations to a central control point. With the increasingly high equipment investments in transmitting high voltages, the advantages of the Westinghouse power line carrier become even more important . . . whether the unit is for automatic remote *operation*, *control* or *protection*.

Completely transistorized with printed circuits, the Westinghouse carrier provides a new standard of reliability. In addition to remarkably low maintenance, this unit draws only one-tenth the conventional power, requires but one-twentieth the space. Interchannel interference virtually disappears, allowing more, fully reliable channels in the same band width.

A new concept in distance relaying

The advanced design . . . K-Dar system

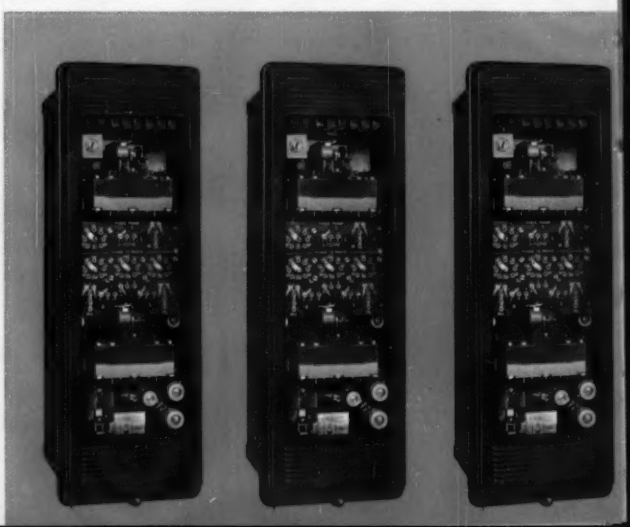
System interruptions on supervoltage transmission lines will be mighty expensive. Damage and outage due to sustained fault current cannot be tolerated . . . nor can the costly repair bill which follows.

The new Westinghouse K-Dar protective relaying system, combined with Westinghouse carrier or micro-wave, provides high-speed simultaneous relay operation at both ends of faulty line sections, permitting maximum service continuity, faster reclosing and improved system stability.

The K-Dar system is the result of wide application and design experience of Westinghouse engineers in Relay, Switchgear, Industry Engineering and associated departments.

The K-Dar distance relay system has a range of 0.75 to 20 ohms and can be set to protect 90 percent of a line section when used as a distance relaying system without carrier transmission. CP-1045

Advanced design, simplified settings, low-burden and high-speed operation add up to reliable protection, ease of application and low maintenance costs.



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Snyder Plugs Heating to IAEL

AG&E sales manager tells electrical league representatives electric heating means business for contractor, dealer, others

American Gas & Electric's E.A. "Al" Snyder, Manager of its sales division, told the 22nd Annual Conference of the International Association of Electrical Leagues (p 74) what electric heating means to contractors, dealers, electricians, distributors and others making up League membership.

Directing his remarks first toward the electrical contractor, Snyder pointed out the possibilities of selling wiring "up" when electric heating goes into the home. Said he, "There is the additional wiring to the electric heating equipment. Practically every electrically heated home has a circuit for a range, a water heater and a dryer. The additional wiring alone may mean as much as $300 over and above what you would sell to an average home not having electrical heating and other major appliances. . . ."

SNYDER

The electrical heating equipment dealer comes in for his share of the gravy too, according to the AG&E executive. "What about the electrical equipment dealer? Certainly he has the same type of opportunities I have just enumerated for the electrical contractor, perhaps to an even greater extent. He, too can get into the house heating business, and sell heating equipment."

Snyder went on to tell the conferees that the reputed extra cost of electric heating should not stop them from selling it. Very often the extra cost, if there is any, is much less than would be expected. Sell the stuff on its advantages, and "let the customer decide."

Don't neglect the old-home market in selling electric heating, Snyder cautioned. There are millions of old homes in this country with worn out or broken heating systems, and most of them are good prospects for electric heating. Big problem is insulation. Here he had a piece of advice for equipment dealers and contractors. ". . . take on (a line of) insulation and storm doors and windows so as to be able to quote the entire installation, or align your self with an insulation dealer and work out a mutually satisfactory arrangement."

Synder touched on the opportunities for heat pumps. When their cost is halved, which he expects will happen in the near future, and a greater variety of sizes and models become available, there will be a great market for them.

C & I Market is Growing

He mentioned the growing commercial-industrial market for electric heating, and how AG&E in a recent survey discovered that it had more than a million sq ft of space in this category heated electrically.

In winding up his presentation, Snyder tied electric heating into the two big industry residential market development programs — Housepower and Live Better Electrically: "I can't help but suggest that when electric heating and the heat pump are promoted, both of which all for heavier service facilities to the home or place of business, Housepower becomes mighty important . . . Live Better Electrically can become one of the hardest hitting movements we have ever had in this industry because with electric heating and year-round air conditioning with the heat pump, one really does live better electrically."

(*More Selling on page* 88)

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

Trim Cost, Noise, With Electric Fork Lifts

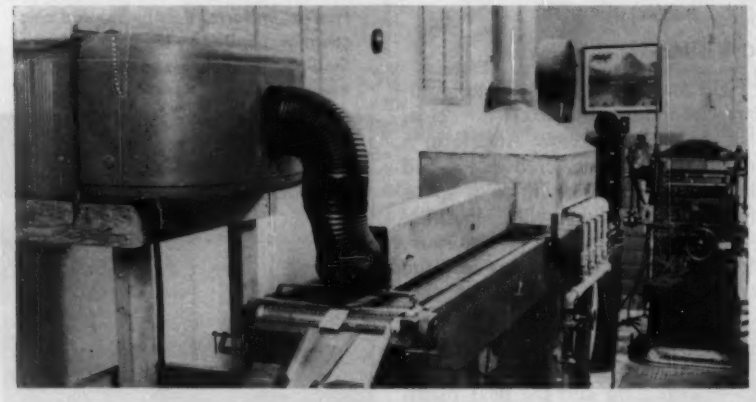
J. C. HANDY, Industrial Power Engineer, Baltimore Gas & Electric Co, Baltimore, Md.

Lower operating costs, less noise, and a cleaner working area are the results of a shift from gasoline to electric powered fork lifts at the Baltimore terminal of the McLean Trucking Co. Operating costs have dropped 75%, according to terminal manager J. W. Marshall.

"We have three electric trucks but we could operate four of them for about the same cost as just one of the old gasoline units. Performance is far superior, too."

The terminal has taken on a new look. Gone are the oil and grease on loading and storage area floors. Gone, too, are the smoke, exhaust fumes, and roaring engine noises. The endless cleaning formerly required to keep floors clean of slippery, fire-inviting trails is no longer necessary.

Because the terminal stays open 24 hours a day and the trucks are used continuously, the terminal maintains two batteries for each truck. One is used on the truck while the second is at the central charging station, being restored. An easy-to-operate electric hoist that travels on a rail above the charging station is used to lift the old batteries from the trucks and install the fresh units. The charging station is shown in the illustration.



Air Conditioning Speeds Card Output

A novel installation at Crescent Card Co, Dallas, Tex., has stepped up printing of embossed cards by 40%, eliminated extra labor costs, and cut stock losses. Dehumidified, 55-C air from a standard room air conditioner is directed on a 4-ft section of the press conveyor belt. The air speeds setting of the rosin dusted over the printed cards, produces cards which have no smears and do not stick together. Previously, in hot and sticky weather, the press had to be stopped while the cards were spread out on blotters by hand to dry the ink and set the rosin. The operation now runs "in the black" year round.

I-R Oven Cracks Bottleneck

DONALD GROOME, Sales Representative, Pennsylvania Power & Light Co, Lancaster, Pa.

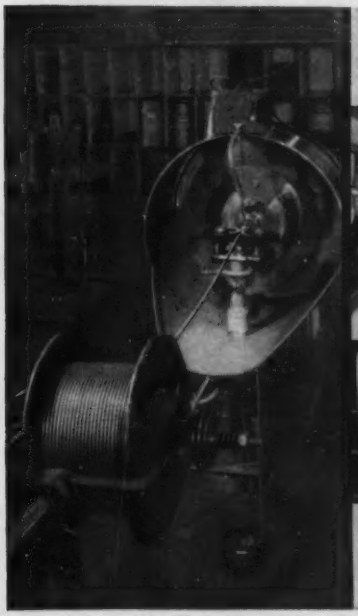
A 200% increase in production and improved product quality are the results of a travelling infra-red oven put in to dry truck-mounted feed mill units at the Daffin Mfg Co, Lancaster, Pa. Using a travelling oven makes it unnecessary to move the truck body and reduces the oven size required to handle the complete body.

Although a 30-kw oven was sufficient to boost the output from one unit to three units per day, a 45-kw oven was installed to provide spare capacity for future growth. No new switchgear was necessary and new wiring was minimized. Before the new unit was installed, physical facilities and weather conditions bottlenecked production, holding output down to one per day.

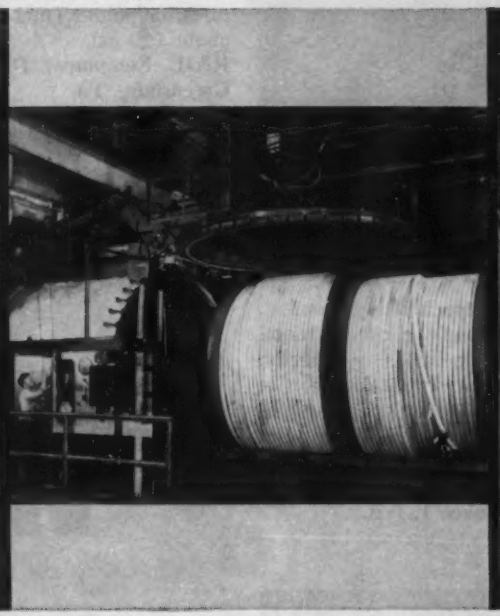
GENERAL CABLE

PAPER INSULATED
VERSATILE · RELIABLE
POWER CABLES

Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.



Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.

Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

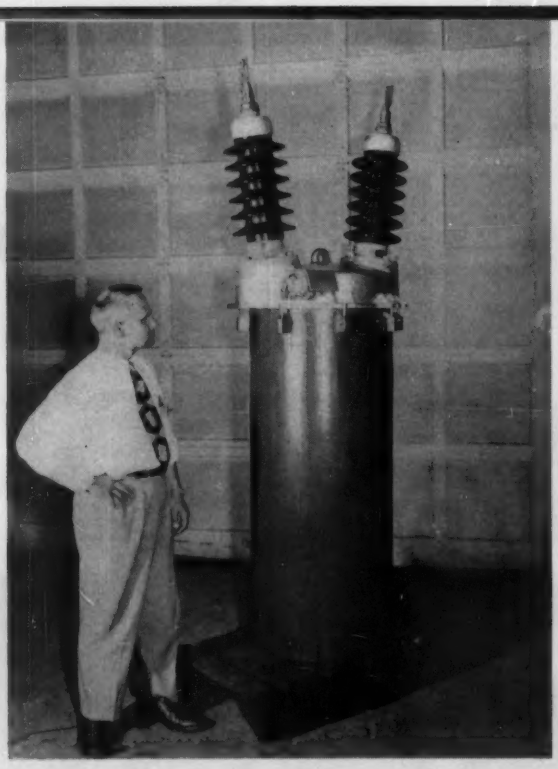
The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and economy... **specify GENERAL CABLE**

NEW EQUIPMENT



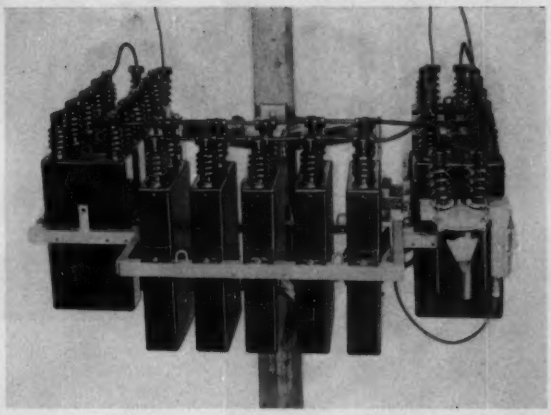
Automatic Recloser . . .

. . . for 46-kv maximum service applications has interrupting rating of 4,000 amp, rms symmetrical, for 34.5 kv; and 3,000 amp for 46 kv. Continuous current ratings are 400, 280, 140, and 100 amp.

Cycle instantaneous tripping of transient faults, followed by 25-cycle reclosing with one, two, or three inverse-time operations provides service reliability at high voltages comparable to that of reclosers performing at distribution voltages.

The recloser can be mounted on ground racks, structures, or poles. Total weight is 975 lb. Oil content is about 150 gal.

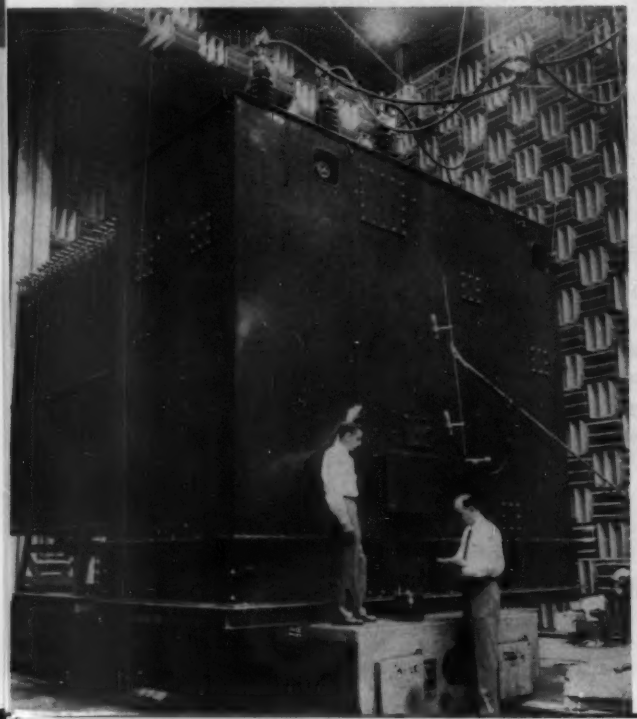
R&IE Equipment Div, I-T-E Circuit Breaker Co, Greensburg, Pa.



Capacitor Rack Assemblies . . .

. . . of cluster type minimize pole bending moment, take little lateral space, leave ample climbing room, and are easy to mount with pole bands or directly. Galvanized-steel capacitor framework has keyhole slot for attachment to cluster bracket. Junction box facilitates connections. Rating: 450, 600, and 750 kvar at 4.16 to 13.8 kv phase-to-phase with 50 kvar capacitor units. Also available with 25-kvar units.

Line Material Industries, Milwaukee 1, Wis.



Power Transformers . . .

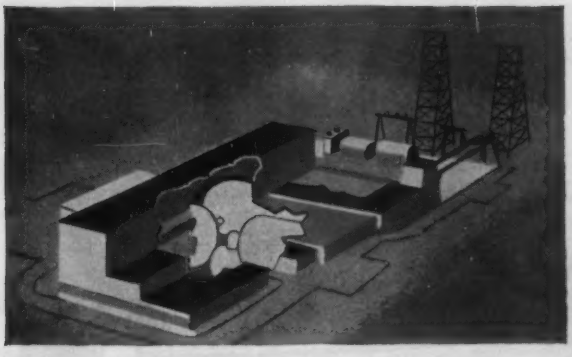
. . . with sound-deadening enclosures are available in ratings from 10,000 kva up. Factory-built steel hoods fitted over the transformer tank give reductions of from 15 to 21 decibels in audio sound levels. The resulting sound energy is only 3% or less of the original audio level.

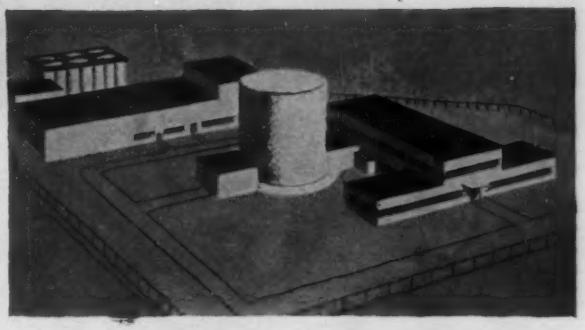
Enclosures are assembled on the transformers in the factory. Batts of sound-absorbent material in the air space between enclosure and transformer tank also help muffle sound.

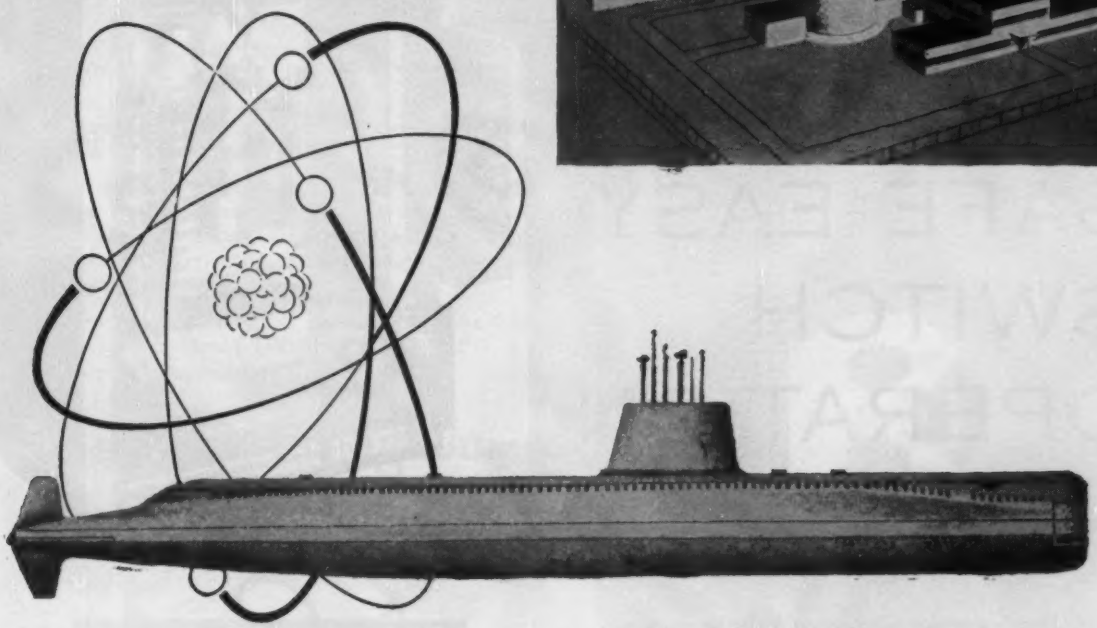
Coolers are outside enclosure, connected to tank by flexible piping. Doors and windows provide for inspection and maintenance. Units can be supplied with or without load-tap-changing equipment.

General Electric Co, Schenectady 5, N. Y.

(*More New Equipment on page* 94)







10 YEARS A PACE SETTER

in all types of nuclear instrumentation and control

As a pioneer in the fledgling atomic industry, Westinghouse has made important contributions to nuclear technology by participating in the early atomic projects . . . the full scale power reactor at Arco, Idaho; the spectacularly successful USS *Nautilus* and the commercial electric power plant at Shippingport.

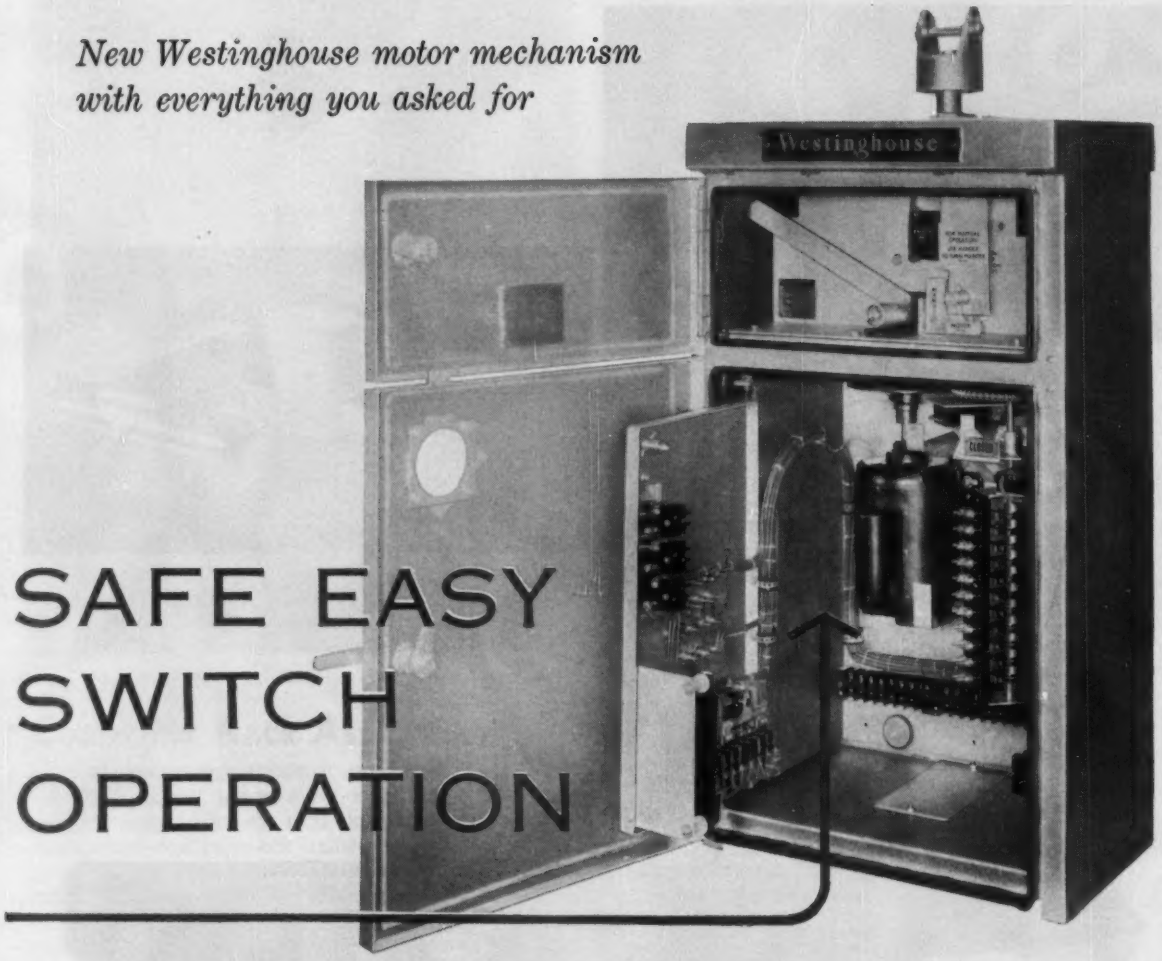
Westinghouse has the engineering and manufacturing know-how and facilities to produce the only complete line of nuclear control and instrumentation equipment available today. Equipment and systems can be designed and manufactured for: reactor power control instrumentation, nuclear instrumentation, reactor coolant instrumentation and radiation monitoring.

Whether your project is a test reactor, marine propulsion or commercial power plant, Westinghouse engineers have the practical experience in the nuclear field to help solve your problem.

For a copy of our colorful new nuclear control and instrumentation booklet (B-7233), or to obtain additional information, write today to Westinghouse Electric Corporation, Nuclear and Marine Sales, P.O. Box 868, Pittsburgh 19, Pa. J-60931

YOU CAN BE SURE... IF IT'S Westinghouse

New Westinghouse motor mechanism with everything you asked for



SAFE EASY SWITCH OPERATION

Here's a motor mechanism with the clean, attractive appearance so important in many switching locations.

The compact cabinet provides completely weather-protected manual operation as well as electric. Neoprene-gasketed doors give cabinet an effective weatherproof seal.

Swinging accessory panel simplifies wiring . . . makes entire mechanism readily accessible. Individually adjustable make-and-break auxiliary switch contacts. Roomy cabinet interior provides ample space for easy field hook-up, extra auxiliary contacts, additional terminals and heater.

For further information about Westinghouse Motor Mechanism or the complete line of Disconnecting Switches, contact your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60934

The single crank handle, stored inside the enclosure, provides easy transition from motor to manual operation. No fuss with awkward accessories to change operation.

YOU CAN BE SURE...IF IT'S Westinghouse

Perfect Contact All the Time . . .
thanks to the NEW concept in shuntless switch design

A new high in continuous and momentary current-carrying ability is reached with the latest Westinghouse innovation on the RL current transfer contacts. The heart of the rotating contact at both hinge and break ends (on RL type switches, rated 7.5 through 69 kv) is a split ring of compressed, silver-plated continuous copper ribbon that offers hundreds of individual point contacts for perfect operation every time. Of course, they are completely encased for absolute weather protection.

The split-ring contact is another advancement in the Westinghouse long-range development program designed to do a better job of serving the utility industries.

Let these Westinghouse quality features and advances work for you: weather-protected biasing springs assure positive positioning of break jaws; oilite bushings on all live-part bearings afford permanent lubrication; one-piece Beryllium cobalt-copper break jaws provide high-pressure line contact.

For complete information, contact your Westinghouse Salesman, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60935

YOU CAN BE SURE... IF IT'S Westinghouse

Safety for the hot-line jobs...

KEARNEY
Hi-Line Jumper Clamp

Recommended for use on all maintenance, repair or construction jobs that can be safely performed by a lineman wearing rubber gloves.

Handles made of high dielectric strength, paper base, ⅛" thick bakelite . . . highly resistant to cuts and punctures, will not deteriorate with age. Will take 10,000 volt jumper cable (cable not furnished with clamps). Area covered with KEARNEY Non-Slip Surfacer assures secure grip on handle. Abrading or scoring the conductor when tightening the handle is eliminated by non-rotating floating ring located in top end of handle and keyed to the clamp head.

Threaded ferrule jumper terminals recommended. Lock nut keeps terminal from backing out of clamp.

-360

JAMES R. KEARNEY CORPORATION • General Offices: 4224-42 Clayton Ave., St. Louis 10, Mo.

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify **KEARNEY PRODUCTS**

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. • GUELPH, ONT., CAN.

Analog Computer . . .

. . . **solves station load impact** and manufacturing problems, and reveals effects of new designs and methods. This table-top computer can handle any problem involving multiplication of two numbers and summing of results. Answers come out in minutes. Operators can be trained in eight hours.
General Electric Co, Computer Dept, Phoenix, Ariz.

Dc Motors . . .

. . . **are explosion-proof,** rated 0.05 to 3 hp, and from 6 to 230 v, and can be supplied in fully sealed submersible, as well as standard totally enclosed construction.
Piqua Machine & Mfg Co, Piqua, Ohio

Line Guards . . .

. . . **maintain air gap** plus plastic between line and man. Internal supports help keep gap if man falls on guard. Installed without connectors, the guards cover 12-kv pin insulators as well as line without using hoods. Available in 4½- and 6-ft lengths or in a double-arm set.
Bodendieck Co, Taylorville, Ill.

Pressure Lugs . . .

. . . **with socket-type set screws** for entrance switches, service troughs, panel boards, and shallow housings. Available in five models for 14-AWG to 500-Mcm cable, the lugs have tightening socket, contact pad, and guide pad of case-hardened steel, and are cadmium plated.
National Electric Products Corp, Gateway Center, Pittsburgh, Pa.

Infrared Control System . . .

. . . protects against intrusion. Source beams invisible modulated infrared light to lead-sulfide photoelectric receiver which may be up to 1,000 ft away. Receiver responds only to its own infrared source, and will signal a beam interruption as short as 0.005 sec. Plug-in control chassis insures ease of installation and maintenance.
Photoswitch Div, Electronics Corp of America, 77 Broadway, Cambridge, Mass.

Data Processing System . . .

. . . has transistorized tape unit that can read or write 60,000 characters per second, checking information for validity and readability at the same time. Synchronizer allows magnetic tape unit to read, compute, and write answers simultaneously. Particularly useful in inventory control, the 705-III has a 40,000-position magnetic core memory, which can be enlarged to 80,000 positions.
International Business Machines Corp, 590 Madison Ave, New York 22, N. Y.

Writing Platform . . .

. . . for use in vehicles mounts on bottom of dashboard flange. Platform measures 8x12 in. with 1-in.-deep basket for storing completed papers welded underneath. A spring clip on top holds unfinished papers. The "desk" is adjustable in all directions, and can be removed from its mount so driver can carry it with him when reading meters. Six- or 12-v lights are optional.
Product Development Corp, Box 789, Norwalk, Conn.

easily installed on hot lines

KEARNEY NON-STATIC INSULATOR CLIP and installing tool

Radio and television interference originating at ball and socket joints of suspension insulators is reduced to tolerable levels by installing KEARNEY Non-Static Insulator Clips. The clips force high pressure contact between large areas of metal of the ball and insulator cap, thus preventing static discharges otherwise caused by overstressing air insulation between the metal parts.

Effective in any position of insulator string from vertical to horizontal, they lock in place, will not fall out. Easily installed on hot lines without disassembling insulator string. Made of heavy spring steel and corrosion protected.

Installing the clips is a simple one-man job with this KEARNEY Installing Tool that fits all insulators; operates at all angles. Thumb pressure loads clip into throat of tool. Suitable for hot line work, the tool is self-positioning on the insulator cap, forces clip into position by screw pressure.

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MEETINGS CALENDAR

OCTOBER

Atomic Industrial Forum—Annual Conference, Coliseum, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

The University of Texas—10th Annual Power Distribution Conference, Austin, Texas, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

American Institute of Electrical Engineers—3rd Annual Farm Electrification Conference, Hotel Nicollet, Minneapolis, Minn. Oct. 29-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

• **Electric Companies Public Information Program**—Mid-Atlantic Meeting, Warwick Hotel, Philadelphia, Pennsylvania, Oct. 31.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1; Nuclear Instrumentation Meeting, New York Coliseum, N. Y., Oct. 31-Nov. 1

Pennsylvania Electric Association—Transmission & Distribution Committees, Lord Baltimore Hotel, Baltimore, Maryland, October 31-November 1.

• **National Metal Trades Association**—58th Annual Convention, Chicago, Ill., Oct. 31-Nov. 2.

NOVEMBER

American Institute of Mining, Metallurgical, and Petroleum Engineers—Metals Division Fall Meeting, Morrison Hotel, Chicago, Nov. 3-7.

American Institute of Electrical Engineers—Ninth Annual Machine Tool Conference, Hotel Schroeder, Milwaukee, Wis., Nov. 4-6; Conference on Magnetism & Magnetic Materials, Sheraton Park Hotel, Washington, D. C., Nov. 18-21.

Edison Electric Institute—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8; Area Development Committee, Phoenix Hotel, Lexington, Ky., Nov. 9; Southern Region Home Service Workshop, Atlanta, Ga., Nov. 12-13; Commercial Lighting Committee, Washington, D. C., Nov. 14-15; Accounting Division Advisory and Executive Committees, The Cloisters, Sea Island, Ga., Nov. 14-15; Street Lighting Committee, Dayton, Ohio, Nov. 21-22; Industrial Power & Heating Group, Atlantic City, N. J., Nov. 21-22.

Pacific Coast Electrical Association—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8; Services Section, Villa Hotel, San Mateo, Calif., Nov. 13-14.

Pennsylvania Electric Association—Prime Movers Committee, Bedford Springs Hotel, Bedford, Pa., Nov. 7-8; System Planning Committee, Van Curler Hotel, Schenectady, N. Y., Nov. 7-8; Electrical Equipment Committee, Ben Franklin Hotel, Philadelphia, Pa., Nov. 14-15.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 11-13; Radio Fall Meeting, King Edward Hotel, Toronto, Canada, Nov. 11-13; Mid-America Electronic Convention, Municipal Auditorium, Kansas City, Mo., Nov. 13-14; New England Radio Engineering Meeting, Mechanics Bldg., Boston, Massachusetts, November 15-16.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

American Standards Association—Eighth National Conference, St. Francis Hotel, San Francisco, Calif., Nov. 13-15.

Southeastern Electric Exchange — Accident Prevention Committee, Dinkler-Tutwiler Hotel, Birmingham, Alabama, November 14-15.

American Society of Refrigerating Engineers—44th Semi-annual Meeting, Shoreland Hotel, Chicago, Illinois, November 14-16.

• **Canadian Electrical Association**—Western Zone, General & Sales Divisions Meeting, Saskatchewan Hotel, Regina, Nov. 14-15; Engineering Division Meeting, Macdonald Hotel, Edmonton, Nov. 18-19.

Air Conditioning & Refrigeration Institute—10th Exposition, International Amphitheatre, Chicago, Ill., Nov. 18-21.

Electric Companies Public Information Program—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

Public Utilities Association—Region II Annual Conference, Mayflower Hotel, Washington, D. C., Nov. 21-22.

DECEMBER

American Society of Mechanical Engineers—Annual Meeting, Statler Hotel, New York City, Dec. 1-6.

American Mining Congress—Annual Membership Meeting, New York, N. Y., Dec. 2.

Edison Electric Institute—Accounting Division Electronics Seminar, sponsored jointly with AGA, Sheraton Cadillac Hotel, Detroit, Mich., Dec. 2-4; Electric Space Heating and Air Conditioning Committee, Cincinnati, Ohio, Dec. 4-6; Industrial Relations Committee, sponsored jointly with New England Personnel Group, Sheraton Plaza Hotel, Boston, Mass., Dec. 5-6; Market Research Committee, Louisville, Ky., Dec. 5-6; Accounting Division Depreciation Committee, sponsored jointly with AGA, Lord Baltimore Hotel, Baltimore, Md., Dec. 9-10; Commercial Cooking & Water Heating Committee, Detroit, Mich., Dec. 12-13.

Electric Companies Public Information Program—Steering Committee, New York City, Dec. 11.

Electric Companies Advertising Program—Management Group Meeting, New York City, Dec. 13.

• Additions this week.

Thorium's Use in Reactors Studied

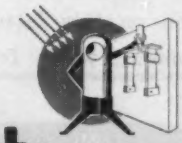
Thorium will be examined as a nuclear fuel for high temperature, gas-cooled reactors. A contract has been awarded to General Electric Co for a zero energy assembly for the British Atomic Energy Authority experimental project, which will probably be at Winfrith Heath. Thorium and uranium 233 will be incorporated in ceramics.

DEPENDABLE OUTDOOR LIGHTING CONTROL

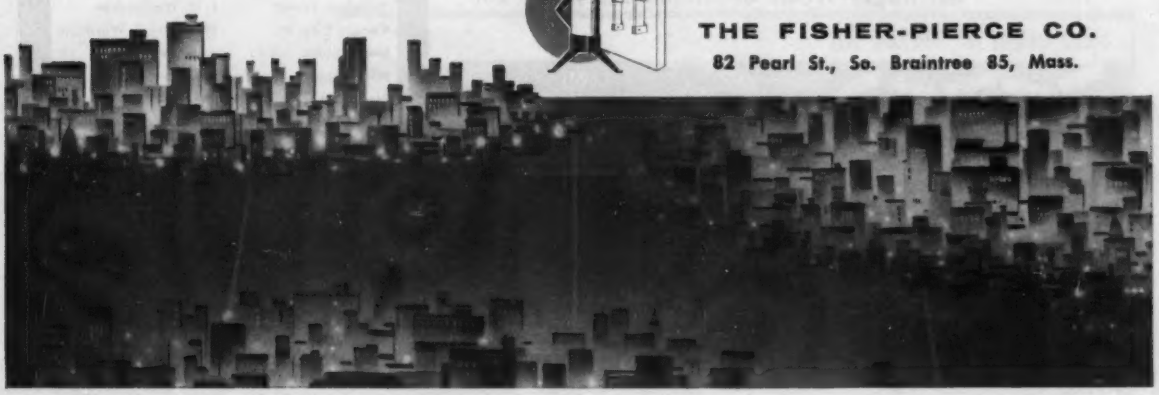
.....from coast to coast

Throughout the United States, Fisher-Pierce units have provided more hours of dependable street light control than any other make of photoelectric control. For more than twelve years Fisher-Pierce has set the pace in the development and manufacture of photoelectric controls for all types of outdoor lighting.

Today Fisher-Pierce, backed by an organization of 600 people, offers unlimited facilities for the development of new controls and allied products for the electric utility industry . . . as well as the extensive service organization that stands behind each F-P control. Whether your requirements call for proven lighting controls for any type of outdoor lighting, development of new electric or electronic products, or engineering service in the installation and maintenance of lighting control systems . . . call on Fisher-Pierce.



THE FISHER-PIERCE CO.
82 Pearl St., So. Braintree 85, Mass.



NEW ALUMINUM WRAP-AROUND CONNECTOR DELIVERS OPTIMUM CONDUCTIVITY

By utilizing the dependable—and the true—measurements of the outside dimension of the bus, our engineers devised a clamp-like connector with a highly polished inside surface. As the weld cools, normal contraction of the polished surface of the connector grips the bus giving optimum conductivity. The fitting is so designed that the metal mass prevents annealling. This perfect encasement seals out atmosphere, preventing oxidation.

For additional information on this latest Schwager-Wood development, write for Bulletin No. 3.

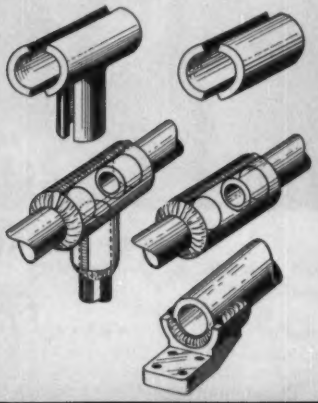
SCHWAGER-WOOD CORP.

Manufacturers of High Voltage Equipment

8024 S. W. 35th Avenue
PORTLAND 19, OREGON

JUST CLAMP ON THE BUS AND WELD!

That's how simple it is to install this new Schwager-Wood aluminum fitting.



SCHWAGER-WOOD SALES REPRESENTATIVES

Birmingham, Ala.	J. B. Burtchaell
Boise, Idaho	B. C. Russell
Chicago, Illinois	Tom E. O'Gara
Dallas, Texas	Tate & Company
Denver, Colo.	Slaybaugh-Thompson
Des Moines, Iowa	Geo. W. Swallow
Houston, Texas	E. H. Warrington
Kansas City, Mo.	The Chas. L. Ward Co.
Los Angeles, Calif.	A. B. Smedley
Minneapolis, Minn.	Pinkney & Hine
New York City, N. Y.	Russell D. Heath
Oklahoma City, Okla.	Harold E. Bates
Oklahoma City, Okla.	R. C. Ramsey Co.
Omaha, Neb.	H. A. Blackman
Salt Lake City, Utah	C. W. Silver Co.
Santurce, P. R.	Victor M. Garcia
San Francisco, Calif	K. M. Ryals Co.
Tacoma, Wash.	Love Electric Co
St. Louis, Mo	Gordon Karraker

ELECTRICAL BUSINESS OUTLOOK

Electrical World
OCTOBER 28, 1957

Don't let '57's disappointments cloud up the long-term appliance picture. Consumers have money, and appliance makers haven't played their high cards yet.

This year has not been a good one so far. Old standbys have moved slower than last year. Refrigerator shipments ran 14% below 1956 for the first 8 months, estimates McGraw-Hill's "Electrical Merchandising." Vacuum cleaners are down 15.5%. Although built-in ranges have climbed 6.5%, the figures on standard ranges dropped 27%, showing up the bright spot as an architectural fancy.

Relative newcomers to appliance lines have fared poorly. Food-waste disposers off 16%; electric dryers off 29%. Washer-dryer combinations have soared up 91%, but this is a drop in the bucket compared with losses in conventional single units—down 18% on 60 times the volume.

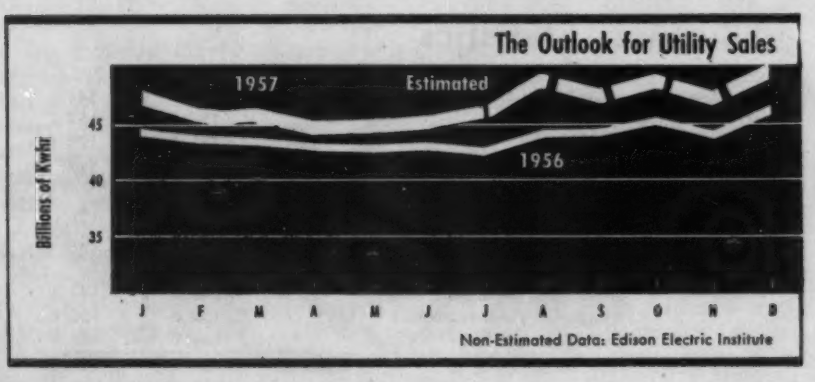
And short-term optimism is not rampant. The fourth quarter hasn't yet shown a convincing sign of an upturn.

Some of this can be chalked up to the lag in homebuilding. Another piece is chargeable to near-saturation in some appliances (an estimated 96% of all wired homes had an electric refrigerator at the beginning of the year). And top-heavy inventories have cut a bit into current sales.

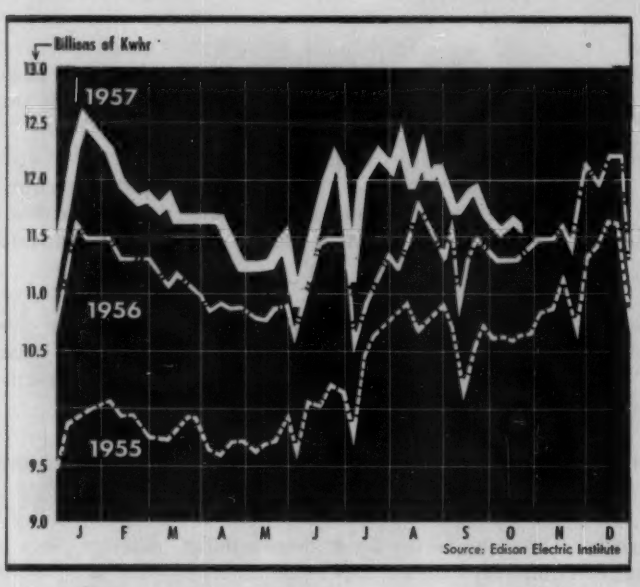
But whatever you charge it to, it can't last forever. Two facts stand out. One is that consumers have more discretionary spending power (that is, money to spend over and above what is required for food, shelter, and clothing). One expert estimates that $210 billion will be available for this type of spending by 1962 as against $170 billion today. It's just that up to now appliance makers haven't been getting their share of these new consumer dollars.

Add the fact that the appliance makers' aces will soon begin to hit the table at a faster rate. These are the new products designed to cut the housewife's workload and substitute increased kwhr use. Ultrasonic dishwashers and home laundries are possibilities—and dishwashers that deliver the dishes to the table. The sum looks like a healthy rise in appliance sales.

For the short pull, appliance sales will tie in pretty closely with new models of products already on the market. Perhaps it will take a good dose of advertising to put the growth back into the appliance picture. The market's there—but it's a competitive one which needs a little selling.



STATISTICS



OUTPUT

Week ended October 19,
11,684,000,000 Kwhr
Up 3.1%

Per Cent Change From Previous Year

	Oct. 5	Oct. 12	Oct. 19
Total U. S.	+2.0	+3.6	+3.1
New Eng.	+3.6	+6.6	+5.8
Mid. Atlan.	+1.1	+3.3	+2.5
Cent. Ind.	+0.8	+1.4	+2.6
West Cent.	+3.3	+5.5	+6.2
Southeast	+4.3	+4.7	+4.5
South Cent.	−3.2	+1.3	+1.5
Rocky Mount.	+2.1	+3.2	−0.3
Pacific			
NW	+1.0	+3.8	+1.4
SW	+5.4	+7.7	+2.9

Seasonally Adjusted Index 226.4
Week Ago 226.9
Year Ago 219.2

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 4.2%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Aug.	125.75	124.99	118.01	6.6
Peak—Class 1 Systems (million kw)	May	97.8	97.7	92.8	5.4
Estimated Dec. '57 Peak (million kw)	July	113.2	113.6	114.4	−1.0
Production—billion kwhr	Aug.	55.45	54.35	52.19	6.2
Hydro		10.03	10.81	9.54	5.1
Fuel		45.42	43.54	42.66	6.5
Sales—billion kwhr	July	48.09	46.99	44.60	7.8
Residential		12.59	11.91	11.42	10.2
Commercial		8.54	7.90	7.75	10.2
Industrial		24.07	24.64	22.76	5.8
Other		2.88	2.54	2.67	7.9
Fuel Consumption	Aug.				
Coal—million tons		13.33	12.72	13.18	1.1
Oil—million barrels		5.79	5.51	5.18	11.8
Gas—billion cu ft		160.96	158.91	142.04	13.3
Net Income Class A & B Co's $—million	Aug.	108.86	100.92	96.45	12.9
Residential Customers—millions	12 mos	46.35	46.26	45.09	2.8
Revenue per kwhr	ended	2.58¢	2.58¢	2.61¢	−1.1
Avg kwhr per customer	July 31	3,082	3,063	2,900	6.3
Avg annual bill		$79.52	$79.03	$75.69	5.1

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Sept.	146	144	146	n.c.
ENR Construction Cost	Oct.	154.5	154.7	147.6	4.7
BLS Cost-of-living	Aug.	121.0	120.8	116.8	3.6
New Orders for Machinery (1950 = 100)	Aug.	134	147	142	−5.6
NEMA Sales					
Insulation materials	Aug.	134	127	153	−12.4
Electric appliances		86	101	100	−14.0
Wholesale prices	Aug.				
Motors and generators		142.5	142.5	133.3	6.9
Transformers and regulators		150.6	150.6	139.7	7.8
Switchgear and fuses		166.9	166.9	153.8	8.5
GNP—annual rate—$ billion	2nd qtr.	434.4	429.1	410.8	5.7

How Should You Post Tax Deferrals?

The handling of deferred tax accounting was debated recently before the New York Society of Security Analysts. Speaker No. 1 was F. M. Beatty, partner in the accounting firm of Arthur Andersen & Co. Beatty recently drew fire by charging in a Federal Power Commission hearing that 17 utilities were overstating income. Speaker No. 2 was Donald C. Cook, executive vice president of American Gas & Electric Service Corp. Cook is a former chairman of the Securities & Exchange Commission. Here's how the debate progressed on the accounting of accelerated amortization and liberalized depreciation:

. . . Said Beatty

We believe that a cost is involved when more depreciation or amortization is taken for federal income tax purposes than is recorded on the books. Such cost should be reflected as an expense. Since it reflects a cost, the credit should be to a reserve account and not to the common stockholders' equity. Thus we believe that the proposed accounting should be made mandatory, not optional.

If a cost has been incurred and the company is permitted to collect this cost in its rates, we believe that sound accounting would require that such cost be recognized by all companies. It should not be optional as to whether a company recognizes such a cost.

If there is no cost involved we do not see how a company can collect these monies in rate determinations. Unless it is permitted to collect the monies represented by deferred taxes in rate determination, the company has no funds to account for, or to use in the expansion of its business, as we understand was the intention of Congress.

We were criticized at a recent Federal Power Commission hearing for our statement that those companies that did not charge their expenses for the costs applicable to taking liberalized depreciation for tax purposes while only recording straight-line depreciation on their books were overstating their earnings, and that the credit for deferred taxes should be in a reserve account and not in the common stockholders' equity.

This criticism stemmed from data furnished the FPC on how 175 utility companies reflected deferred taxes in their 1956 annual reports. Out of 153 companies reporting the problem, 109 charged expense and did not include the credit in common stockholders' equity, 27 companies charged expense and included the credit in common stockholders' equity, and 17 companies made no provision for deferred taxes and hence reflected the benefits of reduced tax payments in income and in earned surplus.

Can it be said that the 17 companies that do not charge their income for deferred taxes are right and that 136 companies that do so are wrong? Are 27 additional companies that include the credit in their common stock equity right and the 109 companies that do not, wrong?

Believing that such credits are not part of the common stockholders' equity, we have been criticized for not qualifying the balance sheets of such companies. These clients are familiar with our views. To date we have not been able to convince them to change their balance sheets.

While we believe we can and should advocate what we believe to be proper accounting principles, we alone do not determine generally accepted accounting principles.

At this point of the development of a generally accepted accounting principle requiring that the credits for deferred taxes be reflected in a reserve account, we have told these clients that we will not penalize them by qualifying our certificate when, to date, such qualification has not generally been followed by other independent accountants.

. . . Said Cook

We believe the accounting treatment that Beatty seeks to impose on the electric utility industry is inferior to the carrying of the normalizing credit to a restricted earned surplus account.

Generally accepted accounting principles are rooted in the concept of matching costs and revenues in fiscal periods. But a sterile adherence of accountants to old concepts in dealing with new phenomena (such as accelerated amortization and liberalized depreciation) would have frustrated the Congressional purposes behind these measures and would have created inequities between present and future customers.

The normalizing process is necessary to deal fairly with present and future customers and fulfill Congress' purposes. Normalizing consists of making a charge to income—with which no actual cost is associated in the current fiscal period—and carrying the offsetting credit directly to a balance sheet account. The charge is the difference between actual income taxes and what they would have been if accelerated amortization and liberalized depreciation had not been taken. It is a charge to expense with which no *current* cost is associated.

As no cost is involved, the normalizing charge hence is income. Accepted accounting principles require income to be credited to earned surplus. Regulatory principles require it to be restricted against payment of dividends. Full information with respect to this matter should be disclosed, and it is disclosed.

Many companies are taking liberalized depreciation for tax purposes but are not normalizing income. They charge on their books straight-line depreciation and the reduced Federal income taxes. This is sometimes called the "flow-through" method —because the increased income flows on through to

net income in the statement. It is then credited to earned surplus as it should be.

I am thus brought to ask you this: How can that which is recognized by everyone as income and earned surplus, when there is no normalization, become something other than income and earned surplus when there *is* normalization?

Obviously their character cannot be changed by the normalizing process, and they remain an accretion to equity.

Other facts about the normalization charge: Cash income actually has been received, but no expense has been incurred in the fiscal period. This cash is retained for use in the business. No liability of any kind to anyone whomsoever has been created. No one can contend that, at the balance sheet date, he has a receivable due from the normalizing company. Hence earned surplus must have been increased.

Thus we see that the cliche "an expense cannot be turned into equity" can only be based on the failure to recognize the normalizing charge for what it is—a sanctioned device for the accomplishment of a meritorious public purpose without prejudice to any class or customers.

Earnings have been received and the preferred treatment is to show them as such by normalizing and carrying the offsetting credit to a restricted earned surplus account. This enables the utility through lower capital costs to serve its customers best at the lowest cost.

The great importance of lower capital costs is shown here:

How Debt and Equity Financing Affect Power Cost

	Percent
Equity @ 15 times earnings	6.67
Federal Income Taxes (52%)	7.23
Total	13.90
Less: Debt	5.00
Difference	8.90

Assume:

AG&E $45 million transferred from restricted surplus to reserve account and replaced by equity.

Then:

Adding financing cost (8.9% x $45 million)	$4,005,000
Total kwhr sold	20,000,000,000
Added cost/kwhr (mills)	0.2

Total increase in annual power cost for an aluminum plant consuming 3.2 billion kwhr (averaging 400,000 kw @ 8,000 hr) $640,000

MANAGEMENT BULLETIN

FINANCE ▸ **The heavy financing schedule has caused some congestion** in the "Financing Calendar" for November, John Childs, vp of Irving Trust Co, has reported. However, it should not be as crowded as October.

A number of bond offerings originally scheduled for the last quarter of 1957, Childs says, have been postponed to early 1958. Issues rescheduled by electric utilities amount to over $100 million. On the other hand numerous utilities have increased the size of this year's bond offerings. It looks now as though total electric utility financing will be less than the $2.6 billion originally scheduled.

RATES ▸ **A $25-million increase in annual revenue has been granted** Southern California Edison Co by California Public Utilities Commission, raising the utility's rate of return to 6.25% on its investment.

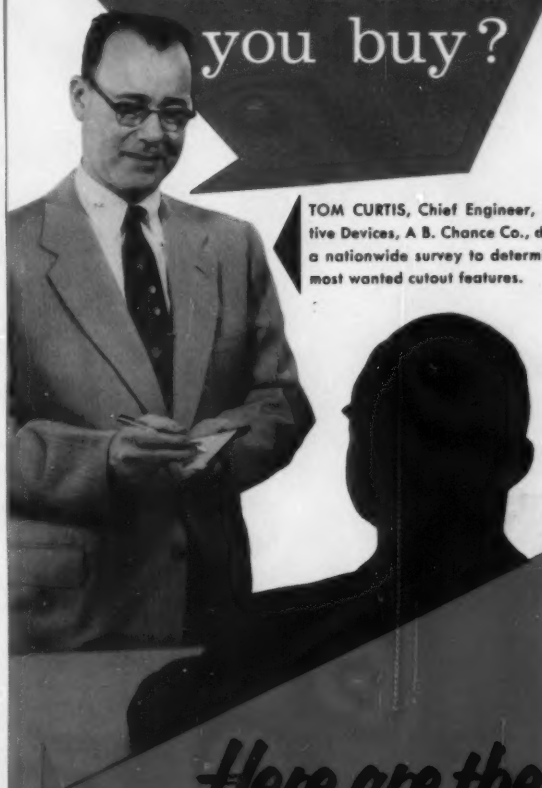
But an escalator clause was vetoed. Clause would have related fuel oil prices to rates. Industrial customers and resale (wholesale) customers would have been affected. Southern Cal had asked for permission to adjust rates seven mills for each 5¢/bbl change in fuel oil prices.

PUC said the utility must treat its income tax expenses, for rate-making purposes, as if it paid normal taxes—even though it might elect accelerated depreciation, and thereby reduce its currently payable income tax. **But the commission said** if Southern Cal should choose rapid depreciation for its property, the commission then will make appropriate rate adjustments.

What do you want in the CUTOUTS you buy?

CHANCE *TYPE "F"* CUTOUTS

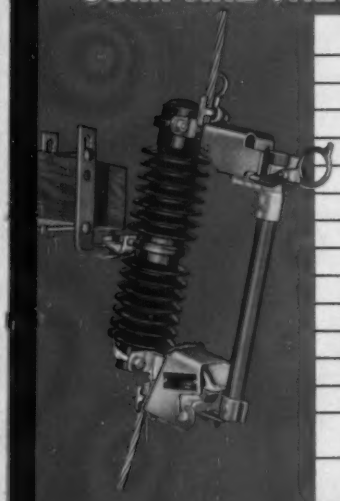
Here's what Utility Company Engineers say about Type F:
"It makes future system conversions simple and inexpensive... "I especially like being able to change from standard to load break... "It's ten times better than the cutouts we have been using ..."You have given us all the things we have asked for in a cutout."
But find out for yourself—compare the Type F, feature by feature, with the cutout you are using today.



TOM CURTIS, Chief Engineer, Protective Devices, A B. Chance Co., directed a nationwide survey to determine the most wanted cutout features.

Here are the features you asked for! *

COMPARE THESE 16 FEATURES



Interchangeable Fuseholders Covering Complete NEMA Range
Wrap Around Insulator Bolts for strength
Bird Proof Construction
Lift and Tie Ring
Universal Terminals—#6 Solid cu. to 3/0 ACSR
Sleet Hoods at Both Ends
Positive Guiding of Tube
Positive Latch—holds tight against surges
All Contact Surfaces Silver Plated
Self Cleaning Contacts
Lever Action When Opening
Link Ejector—aids low fault interruption
Load Break
Fuseholder Cannot be Installed Backwards
180° Stop to Prevent Fuseholder Swinging Back into Pole
NEMA Standard Mounting Bracket

* **A NATIONWIDE FIELD CHECK** of distribution engineers indicated sixteen important features that were wanted in fuse cutouts. *All sixteen* were combined into the Chance Type F Cutout—and *only* the Type F offers all these features!

DEPENDABLE INTERRUPTION

Serving the Utility Industries since 1907

50 YEARS
A. B. CHANCE COMPANY

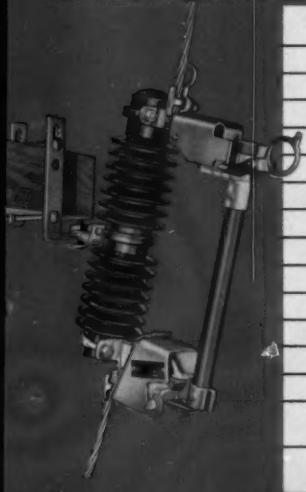
CHANCE *TYPE "F"* CUTOUTS

Here's what Utility Company Engineers say about Type F:
"It makes future system conversions simple and inexpensive... "I especially like being able to change from standard to load break... "It's ten times better than the cutouts we have been using ..."You have given us all the things we have asked for in a cutout."
But find out for yourself—compare the Type F, feature by feature, with the cutout you are using today.

By simply changing the fuseho can be either regular or load interrupting capacities from 7.8 KV ratings and from 2,0

For 200 amp service you can or convert the 100 amp fuse —just remove the contacts wi them with 200 amp contacts

COMPARE THESE 16 FEATURES



	Chance Type "F"	Cutout "O"	Cutout "P"	Cutout "Y"
Interchangeable Fuseholders Covering Complete NEMA Range	YES	NO	YES	NO
Wrap Around Insulator Bolts for strength	YES	YES	NO	YES
Bird Proof Construction	YES	YES	YES	YES
Lift and Tie Ring	YES	NO	NO	NO
Universal Terminals–#6 Solid cu. to 3/0 ACSR	YES	YES	NO	YES
Sleet Hoods at Both Ends	YES	YES	NO	YES
Positive Guiding of Tube	YES	YES	YES	YES
Positive Latch—holds tight against surges	YES	NO	NO	NO
All Contact Surfaces Silver Plated	YES	YES	YES	YES
Self Cleaning Contacts	YES	YES	YES	YES
Lever Action When Opening	YES	NO	NO	NO
Link Ejector—aids low fault interruption	YES	NO	NO	NO
Load Break	YES	YES	YES	YES
Fuseholder Cannot be Installed Backwards	YES	YES	NO	YES
180° Stop to Prevent Fuseholder Swinging Back into Pole	YES	NO	NO	YES
NEMA Standard Mounting Bracket	YES	YES	YES	YES

DEPENDABLE INTERRUPTION...*on BOTH Hi*

Possible Combinations with ONE fuse mounting,

In 5.2, 7.8 or 15 KV ratings

fuseholders, Chance 100 amp Type F Cutouts load-break, and can be altered to increase from 3,000 to 10,000 amps in the 5.2 and n 2,000 to 8,000 amps in the 15 KV rating.

u can purchase 200 amp F Cutouts complete fuse mounting to a 200. The change is simple cts with a screwdriver and wrench, replacing tacts and using 200 amp fuseholders of the desired voltage and interrupting capacity (4,000 or 12,000 amp interrupting capacity in 5.2 and 7.8 KV... 4,000 or 10,000 amp interrupting capacity in 15 KV).

The same solid disconnect blade can be used in either the 100 or 200 amp mounting to convert to a 200 amp disconnect switch. Thus there are eleven possible combinations with one fuse mounting to meet all your future requirements. To get full details, write for the booklet "What do you want in the CUTOUTS you buy?"

NO	NO	YES	NO	NO	
YES	YES	NO	NO	NO	
YES	NO	YES	NO	YES	
NO	NO	NO	YES	YES	
YES	YES	YES	NO	NO	
YES	NO	NO	NO	NO	
YES	NO	YES	YES	YES	
NO	NO	NO	YES	NO	
YES	NO	NO	YES	YES	
YES	YES	NO	YES	YES	
NO	NO	NO	NO	NO	
NO	NO	NO	YES	YES	
YES	YES	YES	YES	NO	
YES	YES	YES	YES	YES	
YES	YES	NO	NO	YES	
YES	YES	YES	YES	YES	

CHANCE *Protectolink* OPEN LINK TYPE CUTOUTS

Protectolink Cutouts are efficent and inexpensive for wide application on rural distribution lines or where high interrupting capacity is not required. All manufacturers' open link fuses can be used in this cutout. Bird-proof construction with wrap-around mounting bolt. Available in two ratings, 7.5 and 15 KV, 50 amperes.

High and Low Faults

ECONOMY PLUS EFFICIENCY

CHANCE Fuse Links and Secondary Fuses

Engineered for system and equipment protection

for coordinated system protection

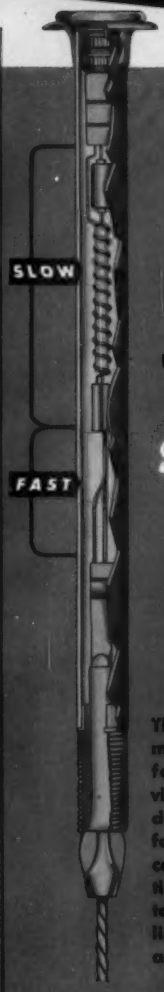
K & T FUSE LINKS

Precision manufactured to EEI-NEMA Interchangeability Standards

These fast (K) or slow (T) fuse links have the uniform quality needed for proper coordination.

Auxiliary tubes on links through 100 amps provide positive circuit interruption of low fault currents.

Low amperage links have a stainless steel ejection spring to further assure low fault current interruption.



for full overload capacity transformer protection without unnecessary outages

SloFast (Dual Element) FUSE LINKS

Follow the ASA safe loading curve for transformers

This exclusive Chance development permits full use of transformer overload capacity—virtually eliminates "burn-outs" due to overloads and secondary faults—isolates transformers in case of failure—improves continuity of service to your customers. Buttonhead and open link styles from 0.2 to 10.4 amps inclusive.

for complete secondary system fusing

Type CTSI Indicating Fuses

Here's secondary fusing that gives you protection from overload problems on your secondary systems . . . isolates failed capacitors or faulted sections—isolates transformers—localizes outages to help maintain customer service. Red plastic semaphore is released automatically when fuse element ruptures—can be easily spotted from the ground. From 5 to 200 amps inclusive. Available with insulated leads, as shown, or with bare leads.

All Chance Links and Fuses have exclusive lead-coated corrosion-resistant copper leads.

PACKAGED FOR EASY REMOVAL

Linemen can easily remove links from containers while wearing gloves. A slight firm twist separates the single container from the 5 unit container. The end of each unit container is perforated for quick removal of the link. Type and rating are clearly marked on both ends of each unit container.

Write for our new bulletin "FUSE LINKS AND HOW TO USE THEM." Address A. B. Chance Company, Centralia, Mo.

CK57-2

A·B·CHANCE CO·

ABC INDUSTRIES

Sangamo Gives Its Watthour Meters a Lifetime Guarantee

Sangamo Electric Co of Springfield, Ill., has advised that all single-phase and polyphase watthour meters, and the watthour meter section of all combination metering instruments are now guaranteed for life. This guarantee includes the materials and workmanship on the meters, and a statement that the ball and jewel bearing system will never need relubrication, inspection or replacement.

Meters covered by the guarantee contain a cobenium ball and sapphire jewel bearing system which has been treated with Molykote ® Microsize, a highly purified molybdenum disulphide. These meters include all single-phase watthour meters with serial numbers above 21,900,000, all polyphase meters with serial numbers above 18,250,000 and all Lincoln combinations with serial numbers above 823,000.

CEMA Cites an 11% Rise in Domestic Production

Domestic production by companies in Canada's electrical manufacturing industry was $1,215,800,000 for 1956, an increase of 11% over 1955, Thomas J. Bell, newly elected president of Canadian Electrical Manufacturers Association, stated at the group's 13th annual meeting on Oct. 11 in Niagara Falls, Ontario.

"This is the second consecutive year that the electrical manufacturing industry has passed the billion dollar mark in production," Bell said, "and barring some unforeseen problem, the industry should maintain its strong economic position in the years to come."

"To avoid any overly optimistic connotation, however, I wish to point out that while this shows a marked improvement over the past two years, it is still far short of the peak 16.6% increase recorded for 1953," Bell added. The electrical manufacturing industry produced $1,094,100,000 worth of goods in 1955, $986,790,000 in 1954 and $973,600,000 in 1953.

The industry's 1956 production figure includes some $139,800,000 worth of washing machines, electric driers, porcelain insulators and other similar products, which are manufactured by the industry but classified by the Dominion Bureau of Statistics under other industries.

Commenting on the current year, Bell stated that "from present indications, it appears that 1957 will result in another peak production

(*Continued on page* 108)

Jasper Blackburn Holds Housewarming

In its recently completed new home at 1525 Woodson Road, St. Louis, Mo., Jasper Blackburn Corp held "open house" which more than 650 persons attended on Oct. 10.

Shown here observing an operation in ground rod production are (from top of stairs) Clifton E. Withers, assistant distribution engineer for Union Electric Co, Francis R. Lengenfeld, distribution design engineer for Union Electric; Ray Leach, president of Blackburn, Fletcher F. Gray, design engineer T & D. Standards for Union Electric Co.; and Ken Way, vice president of Blackburn. The machine shown is a step in the continuous process of making ground rods. Steel rod is passed through cleaning, copper plating and rinsing baths, through dies, and to cutting operation and stock.

The new Blackburn building has 100,000 sq ft of space, 90,000 of which are used for manufacture of electrical equipment and 10,000 sq ft for offices. This modern building is designed so that it can be expanded to 220,000 sq ft with 24,000 sq ft for offices.

WARN HUBS

idle the front drive in 2-wheel drive

Stop Drag
Reduce Wear

© 1957 WARN

OVER 100,000 WARN HUBS NOW IN USE ON 4-WHEEL DRIVES

Free-wheeling 2-wheel drive with Warn Hubs means big savings in gear, engine, tire wear, gas, *plus* the pep, speed, performance and high gear power of *any* 2-wheel drive.

And now, with Warn Lock-O-matics, you have free-wheeling 2-wheel drive, or normal 4-wheel drive automatically, *as you shift!* When you need traction, you have it! When you shift to 2-wheel drive, you *always* have *free-wheeling* 2-wheel drive—with no drag, front gear whine, shimmy. Warn Lock-O-matics truly make "two vehicles out of 1!"

Ask *your* truck dealer for a free demonstration of Warn Lock-O-matic or Locking Hubs (manual control), or write for literature today! Models for all 4 w.ds. to 1½ tons.

WARN MFG. CO. RIVERTON BOX 6064-EW10 SEATTLE 88, WASHINGTON

STEEL

Every Kind

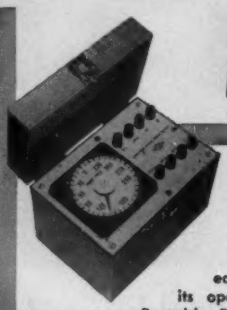
Quick Delivery

Plates, Structurals, Bars, Sheets, Tubes, etc. Carbon, Alloy, Stainless Steels, Babbitt Metal.

RYERSON

Plants at: New York • Philadelphia Boston • Wallingford, Conn. • Charlotte, N. C. • Cincinnati • Cleveland Detroit • Pittsburgh • Buffalo • Chicago Milwaukee • St. Louis • Los Angeles San Francisco • Spokane • Seattle

PORTABLE PHASE ANGLE METER



Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ inches. Weight 19 pounds.

Also available in other voltage combinations
Write for Bulletin #75 for complete information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

CEMA Cites 11% Rise

(*Continued from page* 107)

year for Canada's electrical manufacturers. However, a large part of electrical manufacturing production is tied closely to the construction industry, and the shortage of building money indicates a further levelling off in construction."

Companies in Canada's electrical manufacturing industry realized an average profit on their sales dollar of 3.3% for 1956, B. Napier Simpson, general manager of CEMA stated.

Simpson added that "While the 3.3% was a gratifying increase in relation to the industry's profit margin over the past two years, it is still rated among the lowest profit margins in the history of the industry."

"This compares with an overall average profit of 5.8% for all manufacturing industry in Canada during 1956, according to the survey made by the Canadian Manufacturers Association," he emphasized.

The electrical manufacturing industry reported profits on the sales dollar of 2.9% in 1955, 2.6% in 1954, 4% in 1953 and 4.1% in 1952.

Simpson further stated that "CEMA's annual survey of electrical manufacturing companies shows only 0.8% of the average profit margin was paid in dividends. This is the same as for 1955 and represents the lowest average payment in the industry's history. Remaining 2.5% of the profit margin was reinvested in business to cover plant and equipment expansion, modernization and replacement costs. Depreciation during the year averaged 1.7%."

A-C & S. M. Smith Get Nod for 12 Niagara Turbines

The New York State Power Authority announced acceptance of a bid submitted jointly by Allis-Chalmers Manufacturing Co, Milwaukee and S. Morgan Smith, York, Pa. for furnishing 12 hydraulic pump turbines together with welded spiral casings for the Tuscarora

(*Continued on page* 110)

Line patrol. The Universal 'Jeep' carries patrol and service crews and equipment along the right of way to structures in off-road locations. It travels in conventional 2-wheel drive at highway speeds, but shifts easily into 4-wheel drive for extra traction to go through mud, soft earth, sand or heavy brush—or climb steep grades—where other vehicles can't go.

How 'Jeep' vehicles cut costs on construction and service jobs

The new and bigger Forward Control 'Jeep' FC-170 Truck. This 7,000-lb. GVW workhorse puts a 9-ft. pickup box on a 103½-inch wheelbase. You get unequalled cargo space per inch of wheelbase, plus 'Jeep' maneuverability to carry payloads up to 3500-pounds almost anywhere!

Trenching. The 'Jeep'-propelled trencher digs up to 800 feet of clean-cut 6-ft. deep trench per hour, to speed the installation of cable, conduit and service lines. Unit travels at highway speeds between jobs.

From line installation through maintenance and other service activities... the electrical industry is served on job after job 24 hours a day by 4-wheel drive 'Jeep' vehicles.

With the extra traction of their 4-wheel drive, 'Jeep' vehicles take crews and equipment off the road, right to the tower or substation, wherever service is required.

'Jeep' vehicles with power take-off operate a wide range of equipment, including generators ... compressors ... mowers ... post hole diggers ... winches ... and many more.

Learn how the electrical industry uses multi-purpose 'Jeep' vehicles for hundreds of different jobs, from installing meters to stringing high lines, and how these vehicles save owners money through long life and low maintenance costs. See your Willys dealer today, or write for information.

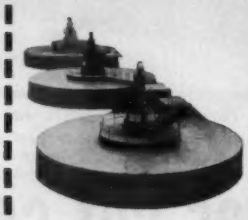
The 'Jeep'®

family of 4-wheel drive vehicles

WILLYS... makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

100,000 Kw. under control . . . NELSON CONTROL . . . at Gavins Point Dam



This control room, equipped with Nelson instrument panels, control panels and consoles is the nerve center of Gavins Point Dam, South Dakota, which generates 100,000 kilowatts of electricity.

At Nelson Electric Manufacturing Company, engineering know-how and manufacturing skill are combined in producing instrument panels, control panels and graphic panel boards that meet, in every detail, the specifications of each customer.

When quality is important, specify NELSON for the best in electrical control equipment.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

A-C & S. M. Smith

(*Continued from page* 108)

Pump Turbine Power Plant of the Niagara Power Project.

In its letter of intent to the bidders the Authority explained that acceptance of the $11,083,350 bid was conditioned on the Authority receiving a license from the Federal Power Commission to build the Niagara Power Project.

The 28,000-hp pump turbine will pump water into a storage reservoir whenever it is not needed for generating power and to generate power using water from the reservoir, to meet peak demands for power.

On Oct. 30, in the morning bids will be opened for the Tuscarora Plant generators (twelve of 25,000 kva each), and in the afternoon for the Lewiston Plant transformers (thirteen of 180,000 kva-each).

Arrester, Oil Switch Lines Are Expanded by L-M

Two recent developments in distribution equipment—intermediate class lightning arresters and manual-operated models of oil switches—are ready to be marketed by Line Material Industries, Milwaukee, Wis.

The lightning arresters, designated as Type F, are obtainable for ratings from 20 kv through 73 kv. Internally each has a column of valve discs alternated with spark gaps and ceramic rings for proper spacing. Discharge-voltage is said to be excellent and with the impulse sparkover characteristic reportedly combine to give equipment maximum protection. Because of their size and weight the L-M arresters are suitable for mounting directly on transformers or other substation equipment.

Manual remote handle operation and hook-stick operation are the features for the two additional models of L-M's motor-operated Type VR oil switch. The 3-phase switches are rated 15 kv, 400 amp, and 110 kv BIL. The 6-sec rating is 6,000 amp symmetrical. These type VM and VH models can be arranged for pole-top and substation installations.

(*More M & M on page* 112)

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Reddy Kilowatt® is a Regular Guy

. . . feeding an even dependable flow of electricity to lights, appliances, and other electrical equipment—with the help of modern voltage regulators using Mallory heavy-duty electrical contacts.

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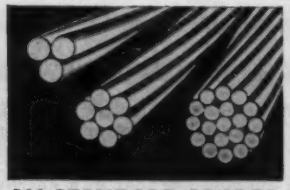
ACCO *It's Aluminized!*

PAGE STRAND

PAGE has successfully combined two time-tested metals into a revolutionary new wire—ACCO ALUMINIZED—that has a ductile, protective coating of aluminum *bonded* to iron and steel wire by a hot-dip method. This product is covered by and is manufactured under processes covered by U.S. and foreign patents.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire applications. Can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware. Here is evidence of ACCO ALUMINIZED Steel Strand's superiority: salt spray tests conducted in strict accordance with ASTM procedures show that, for equal thickness of coating, aluminized *outlasts galvanized by more than 2 to 1.*



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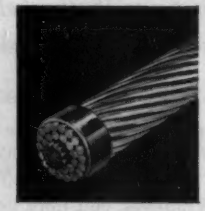
PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

NOTE: We will continue to make and market PAGE Stainless Steel Strand and PAGE Galvanized Strand, as heretofore, in 3-, 7- and 19-wire construction.

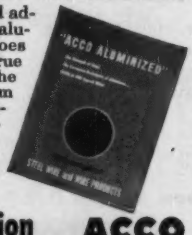
Also...PAGE *Aluminized* ACSR CORE WIRE



Aluminum Conductor Cable with PAGE ACCO ALUMINIZED ACSR Core Wire is now available from many manufacturers of conductor cable. Product quality control is assured by a special testing procedure mutually developed by PAGE and ALCOA.

Send for Informative Booklet

How about ductility and adherence properties of aluminized wire? Why does aluminizing create a true duplex coating over the core? How does aluminum "sacrifice itself" to provide electrochemical protection? For answers, write us at Monessen, Pa., asking for **Booklet DH537-A.**



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ACCO TRADE MARK

M & M BRIEFS

Joslyn Mfg & Supply Co has moved its Eastern Division office to the New York Coffee and Sugar Exchange Building, 79 Pine St., New York, from 70 Pine St.

Electric Storage Battery Co, presented to Franklin Institute, Philadelphia, an educational exhibit of a storage battery. Action of the display consumes about two minutes with a recorded explanation.

Digital Equipment Corp, Maynard (near Boston), Mass., formed to provide testing equipment to the computer industry. Kenneth H. Olsen is president, Harlan E. Anderson, vice president, and Horace S. Ford is board chairman; all were formerly with Massachusetts Institute of Technology.

Micro Balancing, Inc, Garden City Park, N. Y., has a replaceable cell instead of a phototube, and a plug-in electrostatic relay for switching, incorporated in its tubeless street and highway lighting control.

Century Electric Co has set up a 12-man Junior board of directors. Appointed by the senior board, the group represents 12 departments of the firm. They will meet monthly.

Continental Diamond Fibre of Canada Limited is the new name of the Diamond State Fibre Co of Canada Ltd. Name change is to permit closer identity with Continental-Diamond Fibre Corp, Newark, Del., a subsidiary of the Budd Company.

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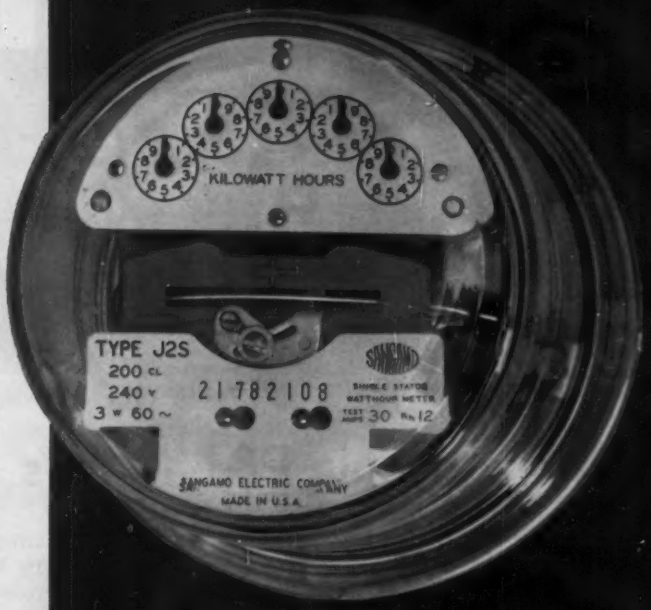
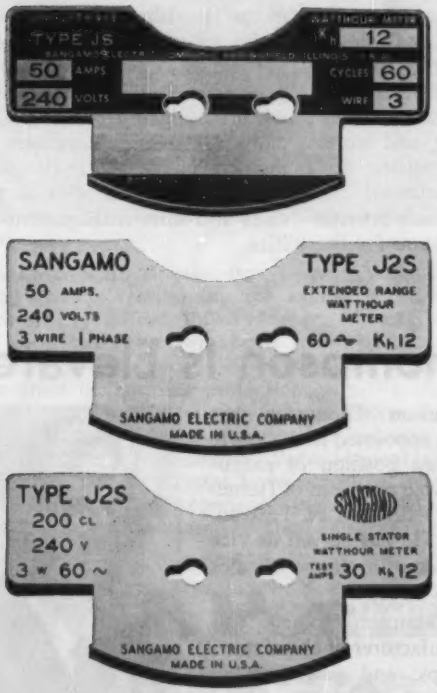
What's new in Class 200 Meters?



With more and more 200 ampere service entrance equipment being installed every day, it's sound practice to match service capacity with metering capacity.

The Sangamo Class 200 Meter can accurately measure all loads—from a few watts to full 200 ampere capacity. Yet the development of 200 ampere capacity meters is nothing new with Sangamo. The Class 200 Meter is backed by 17 years of *proven performance.*

THE NAMEPLATES TELL THE STORY...



IN 1940

Sangamo introduced the Type J Meter, a radical departure in singlephase meter design. It accurately registered loads as great as 200 amperes. The 50 amp. J Meter gave excellent load curves up to such loads as the current carrying capacity of the terminals would allow. These J Meters are on your system—available to do tomorrow's job.

IN 1955

Sangamo developed the J2 Meter—the first extended range meter—a refinement of the basic J Meter. The Type J2 incorporated many improvements over the Type J... increased bearing life, higher resistance to surge voltage, superior voltage characteristics, improved corrosion resistant finishes and materials. The 50 amp. J2 Meter offered straight line accuracy to 200 amperes with only 18 starting watts. These meters are on your lines—ready and waiting for bigger loads.

NOW

Sangamo builds its proven 200 ampere meter as the Class 200, 30 Ampere J2S Meter—with proven accuracy to 200 amperes, lower disk speed, high starting torque, low starting watts.

Make this *proven* Class 200 Meter first choice to measure your ever growing needs. For further information and prices, contact your nearest Sangamo Representative, or write us.

JM57-7

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Electric Company

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D. J. CONNELL

P. W. SIEKMAN

J. S. DAVIDSON

J. S. HANCKEL

Pennsylvania P&L Makes Key Appointments

Heading a recent series of executive promotions at Pennsylvania Power & Light Co was the election of Douglas J. Connell as operating vice president. He succeeds H. Ferguson, who has retired but remains with PP&L as assistant to the president with responsibility for special assignments.

P. W. Siekman was advanced to vice president in charge of the newly organized general services department, John S. Davidson was named to succeed Connell as Scranton Division vice president, and John S. Hanckel was promoted to vice president of the Harrisburg Division.

In addition, F. H. Markley was elevated from treasurer to assistant financial vice president and C. R. Collyer, auditor, was named to replace Markley as treasurer.

Connell comes to his new position after having served as vice president of the Scranton Division since last year. Connell, during his 31 years in the utility industry, has had broad and extensive experience in the field. He was previously associated with the former Scranton Electric Co, which he joined in 1926. Since that time he had served in various capacities and was vice president and assistant general manager of that utility when it merged with PP&L last year.

Siekman, who has been with PP&L for more than 30 years, most recently served as assistant general sales manager and assistant to the operating vice president. He will now be responsible for PP&L's new general services department. This includes the purchasing and stores departments, the coal bureau, real estate and claims department, and office services, all of which provide services of a general nature for the utility's major departments, divisions, and districts.

Davidson, until his recent promotion, was vice president of PP&L's Harrisburg Division. He has more than 20 years of executive experience, having started with the company as assistant to the vice president in 1937. Before heading up the Harrisburg Division, he served as Allentown district manager and also as manager of the former Hazelton Division.

Hanckel, who succeeds Davidson in the Harrisburg Division position, is former director of business sales in the utility's general office. He began his utility career 27 years ago, when he joined a predecessor company of PP&L in Lancaster. Since then, he has served in the divisions and in the general office in various sales and sales management capacities.

Bell Heads CEMA

T. J. BELL

Canadian Electrical Manufacturers Association has elected Thomas J. Bell as president for 1957-58.

Bell, who is also president of Fiberglas Canada, Ltd., has been a vice president of CEMA since 1954, and was elected a director in 1952. He has also served as chairman of CEMA's Wire & Cable Division and the Tariff Committee.

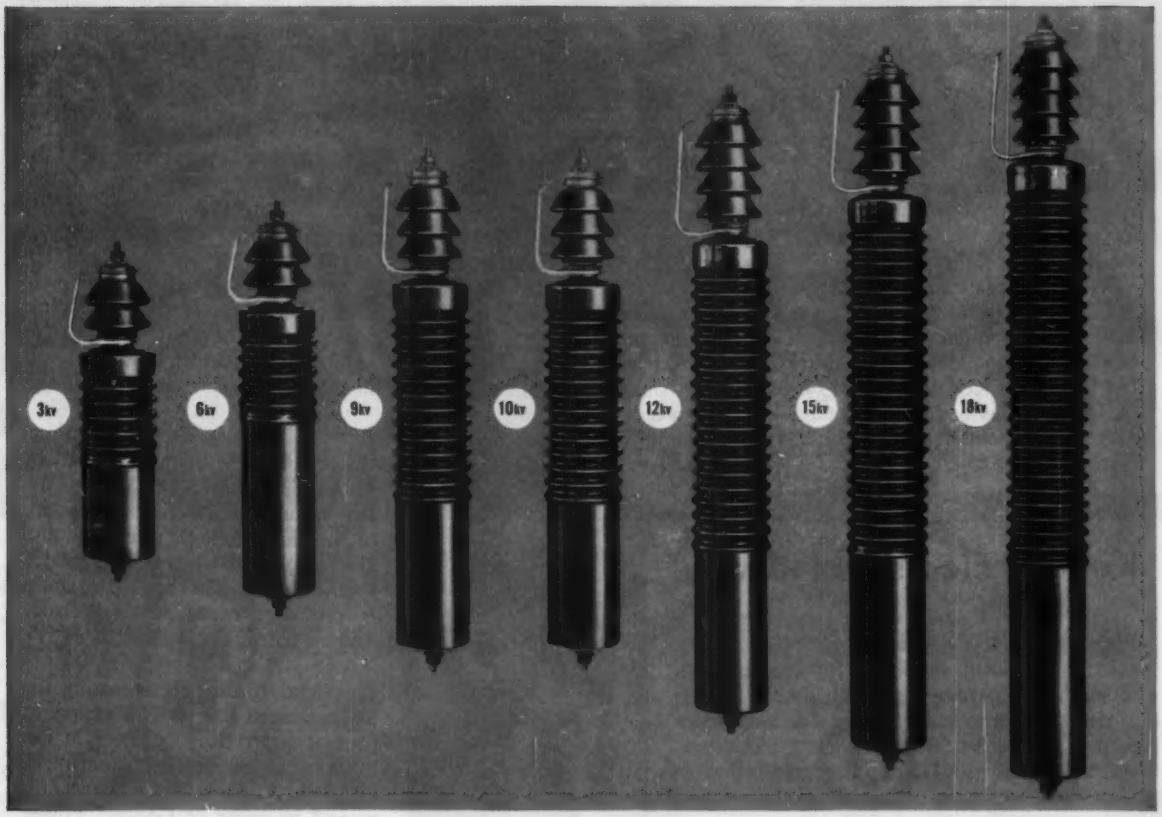
Thompson Is Elevated

Nelson Thompson has been appointed to the newly created position of executive vice president of Homelite, a division of Textron, Inc. He has served as vice president in charge of sales since 1941.

Thompson joined this manufacturer of chain saws, pumps, and generators in 1929 as salesman and later formed Detroit sales area.

NELSON THOMPSON

You get positive protection from line lockouts with these external-gap CRYSTAL VALVE arresters



The famous distribution-type Crystal Valve lightning arrester, containing the exclusive Oxidized-Grain "Crystallite" Valve element, is available in all seven ratings shown above. It represents a half century of experience in developing and producing the finest in lightning protection.

The external gap on the Crystal Valve arrester offers positive protection from line lockouts. The Oxidized-Grain "Crystallite" Valve element, an exclusive feature of Crystal Valve arresters, provides lower unit internal impedance, higher arc-suppressive ability, and increased thermal or surge-current-carrying capacity than ordinary valve elements.

Service records covering thousands of installations show that Crystal Valve external-gap arresters rate better than 99% perfect. To assure virtual elimination of power failures or costly transformer damage due to lightning, specify external-gap Crystal Valve arresters for your power line equipment.

Crystal Valve arresters are available for either cross-arm or tank mounting. For additional information, write Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th and Cambria Sts., Philadelphia 32, Pa.

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S. B. FRANK

J. T. FINLEY

LINCOLN WAGNER

Kearney Names Three VP's

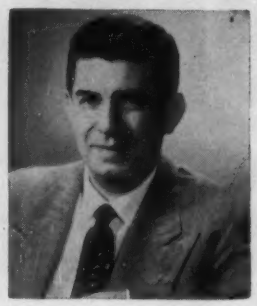
Three newly named vice presidents of the James R. Kearney manufacturing firm are Sam B. Frank, John T. Finley, and Lincoln Wagner.

Frank was elected as vice president and assistant sales manager. An electrical engineering graduate of Washington University, Frank has been with Kearney since 1945. In 1946 he was named direct engineering representative in the Southeast.

Finley, who becomes vice president and chief engineer, has been chief engineer since 1952. During his 22 years with the company he has had experience in both product design and testing and has also been assistant chief engineer.

Wagner, now vice president and assistant treasurer, has been with the firm since 1934. Since then he has been cost accountant, chief cost accountant, chief accountant, and assistant treasurer of the firm.

Kellogg Elects Oblad VP



The M. W. Kellogg Co, a subsidiary of Pullman, Inc, has elected Dr Alex G. Oblad as vice president in charge of the firm's research and development activities.

Dr Oblad, who has authored a number of patents and technical papers, most recently was associated with Houdry Process Corp as vice president of research and development and member of the board of directors.

OBITUARY

A. P. Coolidge, 45, residential and commercial sales manager for Southwestern Public Service Co, died from a heart condition in Amarillo, Tex.

George R. Payne, 46, statistical director of Edison Electric Institute, died recently of a heart attack. During his 23 years with EEI, he made many significant contributions to the development of statistics for the electric industry. He helped develop the Industrial Electricity Output Index, the enlarged annual Statistical Bulletin of EEI, the Semi-Annual Electric Power Surveys, the AGA-EEI annual statistical report form, and the Glossary of Electric Terms.

B. F. Pickard, 69, chairman of the board of Interstate Power Co, died recently in Dubuque, Iowa, following a short illness. Pickard, who was Interstate's chief executive officer for 18 years, was also a director of Edison Electric Institute, president of Iowa Utilities Association, and president of the North Central Electric Association.

PERSONAL BRIEFS

Frank Reis is new general sales manager of Pacific Power & Light Co. He has been acting sales manager since last January.

At Philadelphia Electric Co, **C. W. Watson** was named assistant to the president, **George R. Richard** as superintendent of the station economy division, **Rankin D. Meyer** as superintendent of Delaware station, and **W. Howard Jarman** as assistant superintendent there.

Jack A. MacCracken has been appointed lighting engineer for the New England Power Service Co to succeed **John W. Young,** retired.

Milwaukee Gas Light Co has appointed **Lloyd J. Klein,** vice president of research and economic planning, to the additional post of controller. **Harold C. Garvens** was made assistant secretary-treasurer.

Seattle City Light's new Contract Construction Division is headed by **E. R. Schindler . . . Richard N. Benjamin** has been elected president of Jamaica Public Service, Ltd., and chairman of the board of Jamaica Public Service Co, Ltd. Benjamin is president of Stone & Webster Service Corp.

Cleveland Electric Illuminating Co has advanced **Robert L. Dombey** to general supervising engineer in the mechanical engineering department . . . **Paul F. Eisenhart** was recently named manager of Georgia Power Co's land department, and **James T. Smith, Jr,** assistant manager.

General Electric Co's manufacturing services has appointed **Stephen B. Fuerst** consultant-manufacturing engineering research, manufacturing engineering service. In addition, **Sheldon R. Lewis** was named manager of traffic service for the component.

Line Material Industries' **Alwin G. Steinmayer,** vice president of research and engineering, has been named a fellow in the American Institute of Electrical Engineers . . . **E. I. Pollard,** chief electrical engineer of Elliott Co, is new chairman of AIEE's Power Division unit.

Night view, showing the "Leisure House," customer-service building, center of Tampa Electric's active "Live Better Electrically" program. The simplicity of HAPCO's Venetian Column design blends with the modern architecture and maintains a feeling of spaciousness in the well planned parking area.

For Tampa Electric Company...

Trim, modern appearance of HAPCO Poles and Brackets complements "Live Better Electrically" program

By day, the spacious parking area at Tampa Electric Company accommodates office employees and visitors. At night, mercury vapor lamps mounted on HAPCO Poles and Brackets light the way for customer meetings and demonstrations at the "Leisure House." Here, through scheduled demonstrations by trained Home Economists, supplemented by displays of the latest electrical appliances, lighting and air conditioning, Tampa residents truly learn how to "Live Better Electrically."

Although atmospheric corrosion is a major problem in coastal or industrial areas, long service life can be expected from the 24 HAPCO Poles and Brackets here, since both are made from corrosion resistant aluminum. After being "spun" from aluminum alloy, HAPCO Poles and Brackets undergo special heat treating for maximum structural strength. Aluminum's attractive silver grey finish requires no initial or maintenance painting, and lightness in weight means additional savings in transportation and erection costs.

In the complete HAPCO line of Standards and Brackets are designs for all types of outdoor lighting installations. For more information, write to Hubbard Aluminum Products Company, 6301 Butler Street, Pittsburgh 1, Pennsylvania.

Tampa Electric's new headquarters are located on Dale Mabry Highway, midway between the northern city limits and Gandy Boulevard. At night, this heavily travelled, seven mile section of U.S. Route 92 comes brilliantly alive with light from 259 mercury vapor luminaires mounted on 208 HAPCO 8-foot Brackets and 51 HAPCO 6-foot Brackets.

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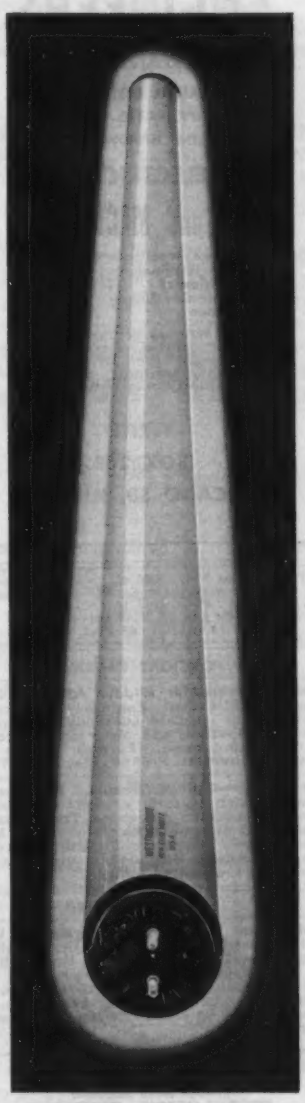
1. New SUPER-HI Fluorescent lamps produce more than twice the light per foot. Designed primarily for high bay (20 feet or higher) industrial and outdoor lighting, a new line of extra high light output fluorescent lamps produce more than twice as much light output per foot as standard fluorescent lamps. The new SUPER-HI lamps permit extremely high energy loading of electrodes, the arc stream and the phosphor. This gives you high light output with new economy at good efficiency and long life.

SUPER-HI lamps are light in weight, convenient to handle and provide a light source subject to the same easy optical control as with present standard T12 lamps, but with over twice the light output. Available in 105, 155, and 205 watts, 4, 6 and 8 ft. The lamps have a rated average useful life of 5000 hours, deliver 6000 to 13,000 initial lumens.

2. High Output Rapid Start lamps give more than 50% more light than regular type. Designed primarily for medium-high bay (15 to 20 feet) industrial and outdoor lighting, four new sizes of Westinghouse high output, rapid start fluorescent lamps can produce over 50% more light than comparable sizes of regular lamps and offer new economy and effectiveness to fluorescent lighting. These lamps provide increased lighting levels, make installations with adequate footcandle values of deluxe color light more practical, and improve the economy and practicability of fluorescent lighting at higher mountings and at lower ambient temperatures.

These lamps are available in 24", 48", 72" and 96" T12 design for general indoor use and for outdoor service where retention of light output at low temperatures is essential. The 72" T12 is recommended for street lighting.



3. Reflector-Fluorescent lamps produce 60% more directed light. For use where external reflectors are difficult or impractical to use, or where dirt deposit cuts lighting effectiveness, these Westinghouse Reflector-Fluorescent lamps provide a directional light distribution which helps put the light where you want it. This is accomplished by a built-in reflecting surface, extending the length of the lamp on the inside of the tube, which redirects about 60% extra light out the other side. Westinghouse Reflector-Fluorescent lamps are recommended for use in coves, showcases and other locations where space is limited. Indirect lighting effects may also be obtained by aiming the lamps toward the ceiling.

They also solve special lighting problems including temporary lighting for construction projects, displays, and exhibits.

Westinghouse Reflector-Fluorescent lamps are available in 40 watt rapid start, 48" and 96" T12 slimline types.

4. Beauty Tone™ Home-line Fluorescent lamps with warm white deluxe color. The same new Westinghouse "Beauty Tone Home-line" lamps which are revolutionizing home lighting by providing warm white deluxe illumination are also ideal for offices, stores and wherever "friendly" color of light is wanted to flatter complexion, enhance the natural color of furnishings, decorations, and displays, and blend well with incandescent lighting.

There's a network of Westinghouse distributors ready to serve you. Call your nearest Westinghouse Supplier for a free Job-Tailored Survey of your lighting requirements. Or write Westinghouse Lamp Division, Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S Westinghouse

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☆ MECHANICAL
☆ ELECTRICAL

Challenging opportunities in rapidly expanding power department of well established firm for men with experience in the design of

Steam Turbines **Generators**

Gas Turbines **Insulation**

Write P-6436, Electrical World Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y. Giving resume of educational background and working experience.

ELECTRICAL ENGINEER

Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.

Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements to:

F-3234, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4984) will be received at Denver, Colorado, until December 3, 1957, for furnishing metal-enclosed, indoor-type, motor control equipment assemblies for controlling nine, 2,400-volt, 520 to 800 hp motors; and five, 480-volt, 280 and 300 hp motors for five pumping plants of the Ventura River Project, California. Delivery is desired within 365 and 425 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DESIGN

ENGINEERS

WANTED

ELECTRICAL DISTRIBUTION
APPARATUS POLE
LINE HARDWARE

ELECTRICAL

CIVIL and MECHANICAL

With some experience in
Electrical Distribution
Transmission or
Communication Pole
Line Design

Old established company undergoing expansion offers splendid opportunity for advancement. Excellent working conditions. Communications strictly confidential.

WRITE

BOX 268

CHICAGO 50, ILLINOIS

REPLIES (Box No.): Address to office nearest you
c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

Position Available: Middle Atlantic State, Graduate Electrical Engineer as Superintendent with intimate knowledge of Generation, Distribution, and Metering, Municipal, 20,000 pop. Steam. Furnish resume and salary requirement. P-5989, Electrical World.

Accountant—College trained. Experienced. Familiar with uniform system of accounts. Two-year contract, renewable. Transportation single or family. Government of Guam, Marianas Islands. Write Public Utility Agency, Box 719, Agana, Guam. State qualifications, references and desired salary.

POSITION WANTED

Professional Eng. of Ontario going to U. S. desires position in electrical or lighting branch; speaks German (born), French, Spanish, state-degree as English interpreter; flexible personality, willing to travel warm climates; specialized in power generation, but likes challenging work. PW-6454, Electrical World.

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
DI. 3-3354

FOR SALE

Entire equipment in modern high voltage laboratory, including 1,500,000 volt surge generator, oscilloscope, camera, standard spheres, and control panel. Also, 60 cps 500,000 volt 500 kva cascaded transformer with control panel, together with 2-ton and 10-ton cranes.

Inspection and Offers for This Equipment Are Solicited.

DEPARTMENT OF ELECTRICAL ENGINEERING
THE TECHNOLOGICAL INSTITUTE
NORTHWESTERN UNIVERSITY
EVANSTON, ILLINOIS

POSITION WANTED

Electrical Engineer, BEE, MBA—Age 28— Married—Eight years broad experience public utility field—Seeking challenging position utilizing engineering and business training—Preferred location northeast or west coast. PW-6439, Electrical World.

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When you are in need of specialized men for specialized jobs, contact them through an employment ad in a McGraw-Hill Publication.

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ELECTRICAL MERCHANDISING
ELECTRICAL WHOLESALING
ELECTRICAL WORLD
ELECTRONICS
ENGINEERING AND MINING JOURNAL
ENGINEERING NEWS-RECORD
FACTORY MANAGEMENT AND MAINTENANCE
FLEET OWNER
FOOD ENGINEERING
NATIONAL PETROLEUM NEWS
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THE MEN WHO READ THE

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GET RELIABLE CAPACITOR SWITCHING AT LOW COST

This General Electric heavy-duty time switch provides reliable low-cost control for capacitor switching. Dependability and long service life mean you save on maintenance costs, too. These features of the TSA-40 time switch make it an outstanding buy:

- Exclusive contact shearing action breaks welds and keeps contacts clean.
- Completely rain-tight case gives protection in all climates.
- Extended temperature range allows operation in temperatures from −50 to 150° F.
- More wiring space and removable cover simplify installation and maintenance.
- Off-the-shelf delivery means you can get the TSA-40 *when you need it.*

Contact your local G-E time switch distributor or send for free bulletins listed below today!

GENERAL ELECTRIC

SECTION C584-15
GENERAL ELECTRIC CO.
SCHENECTADY 5, N. Y.

☐ Please send me free bulletin GEA-6468A on the TSA-40 time switch.

☐ Please send me free bulletin GEA-6681 on complete TSA time switch line.

NAME.....

POSITION.....

STREET.....

CITY..... STATE.....

ROEBLING TELLURIUM LEAD ALLOY SHEATH...

NO AGE-HARDENING PROBLEMS!

There's nothing worse to an electrical utilities system than hardening of the arteries. That's a problem eliminated by Roebling Tellurium Lead Alloy Sheath! Even after 6½ years' life (in the lab and on the job), age-hardening is negligible in this remarkable sheath. Moreover, heat stability is outstanding ... bending life is 4½ times greater than that of ordinary sheath ... there's almost no "creep" at all!

The Roebling Paper Power Cable inside is built for dependability and long life, too. In fact, there's no better buy than Roebling Paper Power Cable with Tellurium Lead Alloy Sheath! An interesting technical booklet, now available, tells you exactly *why* it's such a good investment. Write for your free copy to: Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roebling electrical wires and cables are available with either copper or aluminum conductors.

Federal Pacific electrical installation highlights new Lincoln Tunnel

Smooth operation of this vital New York/New Jersey traffic artery depends on the continuous, unfailing flow of electricity. Keeping the air free from deadly exhaust fumes...insuring constant illumination...providing uninterrupted traffic control calls for a wide range of highly dependable electrical control and distribution equipment.

That's why Federal Pacific equipment was selected for the job. "Fail-proof" power continuity, for example, is assured by duplicate substations at both ends of the tube ...each fed by two separate utilities. Substations are tied-in with Federal Pacific bus and switchgear so that 460 volt power can be drawn from either or both utilities on a selective basis. A special substation, consisting of twelve 25 kva transformers, twelve 50 kva transformers, and mechanically interlocked air switchgear of 50,000 amps interrupting capacity, was installed to facilitate the change to fluorescent lighting.

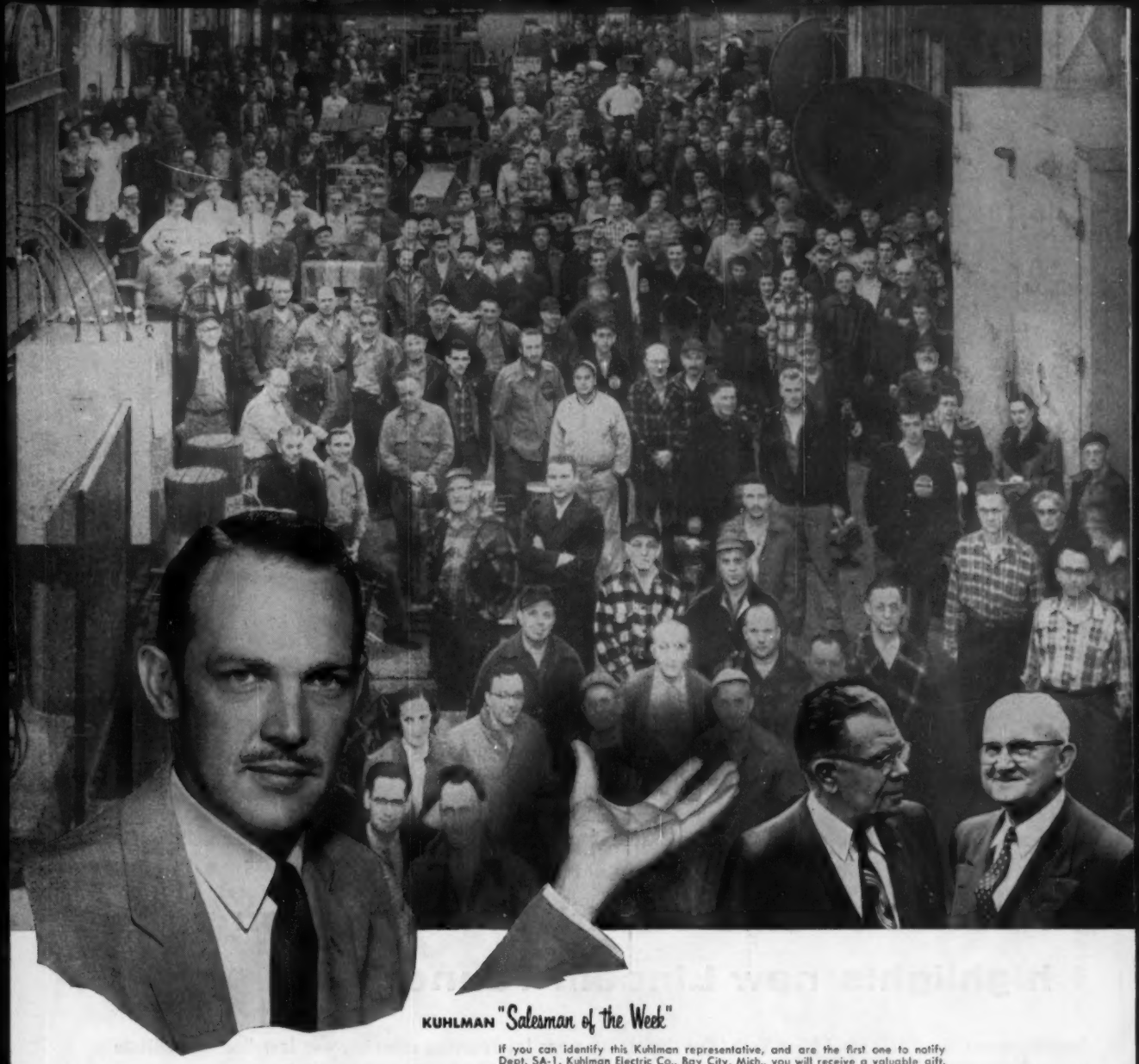
In addition, Federal Pacific built special control panels required for the advanced ventilation and traffic control system planned for the job. A single attendant at these control panels can maintain uninterrupted supervision of ventilation and traffic in all three tubes and along approaches.

As one of America's leading electrical manufacturers, Federal Pacific stands ready to supply complete electrical distribution systems *from start to finish*. That's why more and more progressive managements across the country are specifying Federal Pacific equipment for their electrical installations.

FEDERAL PACIFIC ELECTRIC COMPANY
Main Offices: 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity



KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift.

"Meet the people who make Kuhlman transformers"

"The gentleman at the extreme right is John Franklin, our Bay City factory superintendent. John's been building transformers nearly all his life. He has been with the company more than 40 years.

"Next to John is Cliff Lefler, President of our "Quarter Century" Club. Cliff tells me that the club's membership now represents more than 7% of our employment.

"In fact, 50% of our people have been with the company more than 10 years—over 25% more than 15 years!

"Low labor turn-over . . . years of on-the-job experience . . . quality craftsmanship have been our "way of life" since 1894. You'll find us the kind of company you'll enjoy doing business with. Ask anyone of our thousands of satisfied customers."

5718C

KUHLMAN ELECTRIC COMPANY

GENERAL OFFICES: Birmingham, Michigan

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